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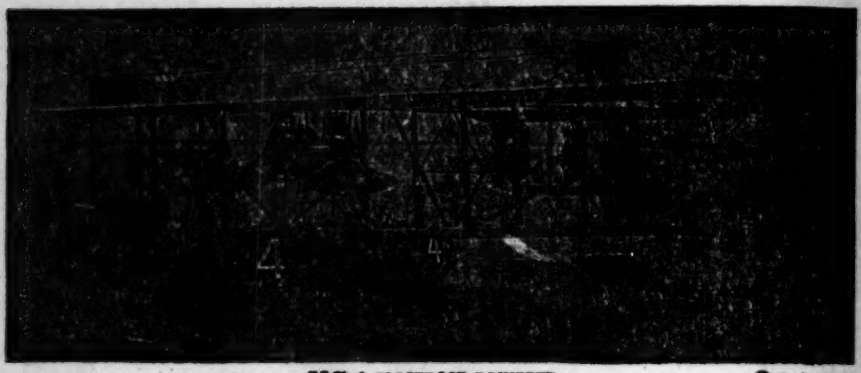

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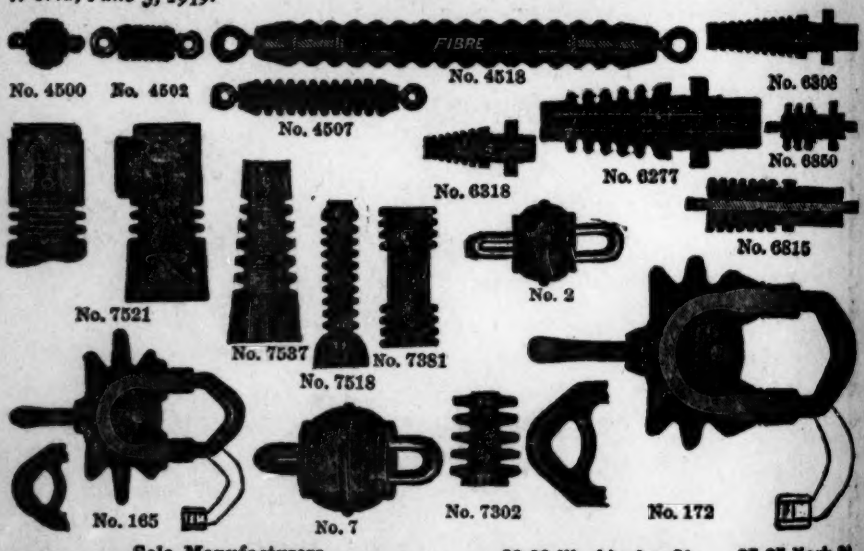

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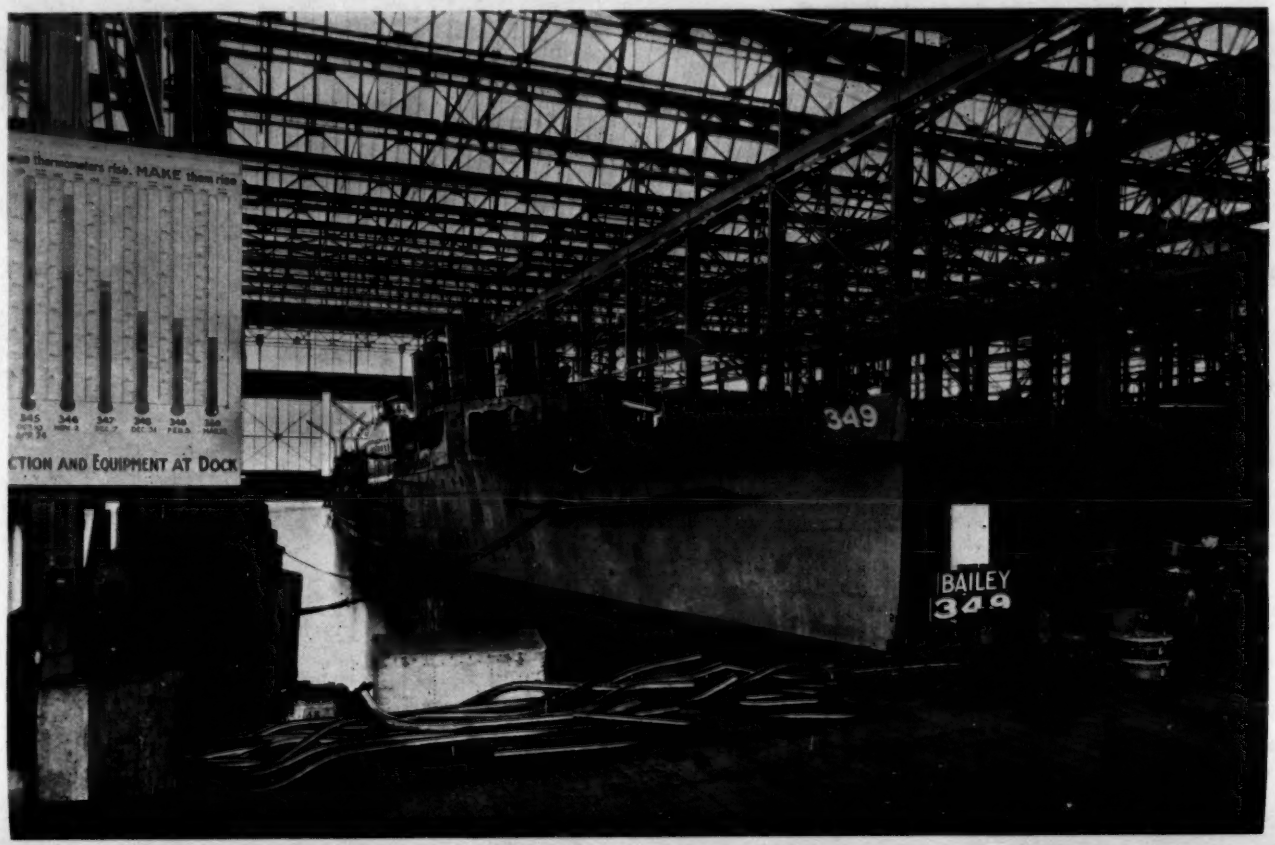

SQUANTUM NAVAL DESTROYER PLANT.
Destroyer in wet dock being fitted out. Note thermometer board at left which shows progress on the various ships.

UNITED STATES NAVAL INSTITUTE PROCEEDINGS

Vol. 46, No. 4 **APRIL, 1920** **Whole No. 206**

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U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

NAVY YARD ADMINISTRATION AS A PROBLEM IN INDUSTRIAL ENGINEERING

By COMMANDER JAMES REED (C. C.), U. S. Navy

1. Among those officers who have been condemned to spend their time and energies in shore establishments during the war, the one unanimously positive conclusion must be that there is something radically wrong with our naval organization as regards the policy of administration of shore stations. There is very little of the dash and glamor of "service in the war zone" in the active supervision in dungarees of the construction or repair of a battleship or destroyer, or in the handling of the billows of correspondence and plans appertaining thereto. No medals are given for this service. It is a hard grind without the thrills of combat, actual or prospective, but there can be no question as to the necessity for its performance.

2. In spite of the admitted importance of the subject, very little impartial consideration has been given in detail to the administration of these shore establishments, especially the *industrial* plants, *i. e.*, the building, manufacturing, fitting out, and repair stations. Essays abounding in deep thought and fine phrasing, as well as famous books, have been written to explain the *raison d'être* of a navy, but in practically all of these writings the author was thinking almost, if not entirely, of a navy as an organization of fleets, with, of course, the necessary naval staff for administration and direction. It is the purpose of this article to discuss impartially

Destroyer in wet dock being fitted out. Note thermometer board at left which shows progress on the various ships. SQUANTUM NAVAL DESTROYER PLANT.

the policy of administration and organization of navy yards in the light, not only of the past two years' experience, but also of some twelve years' study along organization lines.

3. Whether the radical changes in the assignment of duties and responsibilities as proposed herein are *militarily* according to precedent and custom, has nothing to do with the discussion, as we are considering this whole question only as a problem in *industrial* reorganization. The author declines to be drawn into any "line or staff" argument on this or any other point brought out in this paper. Either work is *industrial* or it is *military*, and a divorcing of the two must come, either through our own efforts or the spur of a hostile Congressional Committee action, for innumerable perfectly definite examples of inefficiency under the combined milito-industrial scheme can be shown to conclusively prove this point. In the discussion and the examples to be given, the attempt will be made to deal with this problem exactly as though it were simply an *industrial re-organization problem* of the usual type, without any consideration (at first) of the military influence whatever.

4. On this basis, then,

I. Just how efficiently have we performed our several tasks in these stations?

II. How would these tasks be handled by an ideal system based on sound industrial engineering practice?

III. How can we so alter our organization and methods as to approach the ideal?

I

5. A great industrial engineer once said "destroy your whole physical plant and it can be restored in brief time, but lose your *organization* and you have a stupendous task in reconstruction before you." The *personnel* is the thing, as we can many of us recall to our sorrow in the painful results of certain gunnery exercises and steaming competitions.

6. Let us consider then a "first-class navy yard," and beginning at the top, study its organization chart. (*Actual*, not the imaginary one hung up in the commander's or industrial manager's office.) Strange to say these charts vary in all yards, whether under the industrial manager type of administration, or under the good old commandant scheme. We find a little empire, made up of separate

kingdoms, each divided into its principalities and duchies, all as jealous of their prerogatives as they are eager to "slip the buck" to each other for any delays, bad workmanship or errors of any kind. We even find encouragement by the various monarchs, of this party bickering policy between their respective subjects.

Example.—Telegram from a commandant, West Coast Yard, to industrial manager, East Coast Yard, urgently requesting information as to shipment certain articles imperatively needed to complete a destroyer.

Answer.—"Wire referred to engineer officer for reply; shipment will be made as soon as received in store from machinery division who have order for manufacture!"

(Signed) ————,
"Supply Officer!"

7. What a wealth of comforting information for the hungry yard in dire need of the material in question! By all the rules of business and of common sense, this inquiry is entitled to a simple, prompt, direct statement signed by the responsible head of his authorized assistant, that the material *is* or is *not* made and will be shipped on a definite—*named*—date (*never*, "as soon as possible," which conveys no information on which to base any real action whatever).

8. Numerous examples of intra-divisional and departmental squabbling and covetous schemings can be quoted. No officer of experience either in Washington or in any shore station is ignorant of them nor can deny first-hand knowledge of their existence. There are not captious criticisms nor backstairs gossip but *facts*. Let us then come out plainly, admit our faults and seek correction of them.

9. Returning to the chart, let us consider the commandant (of an industrial yard, having no "manager").

10. A modern navy yard represents an investment of government funds (raised by taxation, remember, *i. e.*, the *people's* money) of about $25,000,000. To this yard is sent every two to four years say, a commandant, who may or may not have ever served in the industrial organization of a navy yard before, and who as a general rule never had any modern business experience whatever. For what part of his responsibilities has he been trained to a degree in any way comparable to the president and general manager of the Newport News Shipbuilding and Dry-

dock Company? (This, of course, is through no fault of his and in no way reflects on his ability as a *naval officer*). Is it possible for this man to discharge his responsibility to the people of the United States so far as rendering an economical, efficient management of this $25,000,000 plant is concerned? What private shipyard would employ him in a similar capacity? How many naval officers of *similar training* and experience have been coaxed out of the service by glittering offers from big industrial concerns? Is this not significant?

11. In this connection, let us try and forget at least a part of the ingrained idea that a graduate of the Naval Academy is, *ipso facto*, a technical man of high ability just by virtue of his completion of the four years' course. He simply *isn't*, and the various P. G. courses now fathered, both at Annapolis and at various colleges, clinch this statement. The average graduate of the Naval Academy is in a fair way to become a good *naval* officer, but as a *technical graduate* he rates just behind the juniors in any one of our high grade engineering schools.

12. Furthermore, it has been deemed essential in the training of midshipmen to inculcate into them a spirit of self-confidence reaching dangerously close to conceit; a feeling of their individual ability to handle *any* situation. This is probably a fine quality for a young naval officer to possess, and it acts to give him that fertility of resource and speed of decision so essential in the prompt handling of military emergencies. But in the teaching of this idea, has not there been an almost entire sacrifice of the proper appreciation of the difficulties and problems which confront executives trained in other professions?

13. Hasn't it, in fact, led to almost a touch of contempt for the humble "cit," and to go a step farther, for the young line officers' confreres of the staff? If we grant there is even a slight touch of truth in this, wouldn't it explain the fact that a majority of officers (Naval Academy graduates) serving as industrial managers, commandants, heads of divisions, etc., actually and sincerely believe they are fitted perfectly to the job, and are comparable in fitness to the corresponding executives in similar private establishments?

14. The author holds no brief for the "staff" or for the corps to which he belongs; although the members of the latter, in general, have been chosen from somewhere near the tops of their

respective classes, he believes the percentage of incompetency along industrial management lines just as high in this corps as in any other. He has even reached the conclusion, in some instances, that the high mental horsepower of some of his colleagues had caused a corresponding reduction in this (un)common sense when it came to managerial qualifications. However, the point is, in this corps, a real effort is made to assign the men to duty which is commensurate with their proved ability, *i. e.*, "paper hounds" to desk work, "mental sharks" to design and calculation problems, "practical men" to navy yard assignments, etc.

(There is no denying that "navy politics," as well as other considerations besides demonstrated fitness, will always affect certain assignments to desirable duty. We must simply be philosophical over such exhibitions of human nature in action.)

15. The officer we had under discussion who corresponds in position to general manager in an industrial organization, has eight or nine departments or divisions under him in a navy yard (without counting those strictly military). In several of these departments we find a duplication of personnel, *i. e.*, office superintendents, new work superintendents, shop superintendents, etc., and unless we are in great luck, a duplication also of matériel (buildings, machinery, equipment and supplies).

16. For a fine example, take the New York navy yard, and plot out the *office* locations (and later the organizations) of the commandant, industrial manager, construction officer, engineer officer, public works officer and supply officer. We discover that the offices of the various departments and divisions are each installed in their own buildings, widely and (apparently) purposely separated, doubtless with careful forethought to reduce the bloodshed to a minimum, certainly not with the idea of following modern business practice. In what modern shipyard will one find such an absurd situation as regards separation of the important units in the organization? It is unthinkable.

17. Seeking another specific example, take the handling of heavy weights by Hull *vs.* Machinery Divisions at some yards. Each must have its riggers, helpers and laborers, all with a duplication of gear, one being permitted to handle guns up to 6-inch caliber, for example, and all machinery, whereas the other takes all guns *above* 6-inch caliber and all other heavy weights! No defence can be offered for such a duplication; rigging in or out

guns, or proper slinging of machinery or armor is no mystic rite to any thoroughly qualified rigger under proper supervision.

18. Examples might be multiplied, such as water and oil piping *in* engine and fire-rooms and *outside* them, etc., gratings, sheet metal work, etc. Witness the knotty question of "cognizance of work" both as regards the bureaus of the Navy Department and the divisions and departments in each navy yard! A sea lawyer indeed is he who can master all these intricacies of regulation, instruction and confusion. Some of us at least can recall the constant jockeying incidental to securing some small real or fancied advantage for this or that division in a question of cognizance. We do not have to grope very far back in the cobwebby recesses of our memories to stumble on plenty of specific examples of this pettiness, either. The really efficient performance of the work in *the shop best qualified* was the last consideration that entered the heads of the most of us.

19. Because certain sheet metal work goes on an *exhaust* trunk or on a *boiler*, it must not be touched by the lowly hand of the sheet metal shop, but is "machinery work" and must needs be performed by the *copper* shop or the boiler shop, as this is in charge of the machinery division, although the sheet metal force would seem to be the only logical one to perform all strictly sheet metal work. Then in some yards, we find the "inside shipfitter" of the hull division doing work plainly the logical job for the outside machinist of the machinery division.

20. Examples might be multiplied to the point of weariness, so let us return to the individual case of the commandant, doubtless an efficient and sincere naval officer who is supposed to be in close touch with all industrial activities under his charge ("command"). Was he (or is he ever) selected because of his experience and proven managerial ability? Or was he selected because he was about due for shore duty and this particular billet was available for one of his rank (and *"acceptability"*)? Going down the line, does he find his aides and department heads are men skilled in the duties they are supposed to perform, and especially selected for this reason? He does not.

21. When, for five years, the important position as one of the superintendents of a division in one of our biggest navy yards can be filled by three junior lieutenants in succession, no one of whom had ever been ashore before in his naval career, nor ever

had any industrial experience whatever, our method of selection for these positions is due for a change if we ever expect to accomplish any real efficient handling of our management problems, in which we must have, it will be granted, first, the proper *personnel,* second, the *matériel,* third the *methods.*

22. Can you suggest the name of any large and successful shipbuilding corporation that would enthusiastically employ any one of these young officers as a superintendent immediately on his coming ashore for the first time, earnest, brainy and energetic though each of these officers may be? If *not,* does the reason *why* not suggest itself, and isn't it applicable to our little problem here, providing, of course, we brush aside for the moment the *military* considerations?

23. Our good friend the commandant is given one or more "aides" and we find upon comparing these with our industrial ideal that the "senior aide" is a combination marine superintendent, chief of police, captain of detectives, welfare worker and fire chief, whereas the rest of the "aides" are private secretaries without stenographic ability, whose principal industrial duties are to wield that great innovation, the rubber stamp "*by direction.*" They are in no sense "assistants to the general manager," and most of their industrial duties can be easily and more economically, as well as efficiently, performed by the chief clerk and his force, who at least have the qualities of experience and permanence.

24. Let us dissect out those duties of the senior aide in connection with "yard craft" and we find that 90 per cent of these duties are strictly *industrial.* What arrivals, berthings, dockings, undockings, and transfer of vessels on the waterfront of an "industrial yard" are military, or performed for any military reason whatever? The ship comes to the yard for *work* by the yard force and appliances, not as a military maneuver. Why try to camouflage it as such by forcing the responsible industrial supervisor to request of the military "senior aide" that this ship be berthed here, shifted there, or assisted into dock No. X, using the tugs under his "command"? Why not have these facilities under the direct charge of those who require them? Is it, or is it not, sound business procedure?

25. Again, consider the police functions of the "senior aide" (captain of the yard). Do they check up with the latest and best

plant protection? We find he divides responsibility with nearly everybody including the commanding officer of marines, and hence he cannot be blamed for the conflicts of authority and irritating incidents that occur daily. He would be super-human if he could prevent them. Right here, let it be stated that the strictly military control of interior policing throughout an *industrial* establishment never makes for harmony, either among the mechanics or the supervisors. The absolute intolerance inherent in the military policing is going to become more and more a cause of trouble and friction in our government industrial plants as the independent ideas now spreading so rapidly among the mechanical forces gain in strength. We may as well be prepared to bow gracefully to a situation that is nearing us daily.

26. I shall venture to prophesy that within five years the use of armed marines (or soldiers) in policing the strictly industrial portion of government plants will be abolished, so far as contact with the civilian working personnel is concerned. A regular plant police force will take the place of the military guard in the *industrial yards* similar to that in the Naval Aircraft factory at Philadelphia, and all must admit that plant was thoroughly protected at all times. From the standpoint of economy to the government (*i. e.*, the people of the U. S. A., our *stockholders*) the use of marines for yard police duty is a very extravagant method of protection, except in so far as the relief to the Navy Department working appropriations is concerned.

27. Since the rather arduous but highly instructive experience of two years' active and responsible association with the fire department of one of our largest cities, the author has witnessed so many painful exhibitions by various navy yard fire fighting (?) forces that it is difficult for him to discuss the subject dispassionately. Suffice to say that no uniformed, disciplined force, no matter how *large* or *well officered*, or how well equipped and disciplined, constitutes an efficient *fire-fighting* force unless thoroughly trained in fire *fighting*. If you doubt this, ask the experts, Chief Kenlon of New York, Murphy of Philadelphia, or Major Ray of the U. S. Army, or Powell Evans, president National Fire Prevention Association. That more of our navy yards have not suffered disastrous fires is due partly to thorough patrol, and partly to that inscrutable Providence to which Mr. Taft referred in his much quoted phrase.

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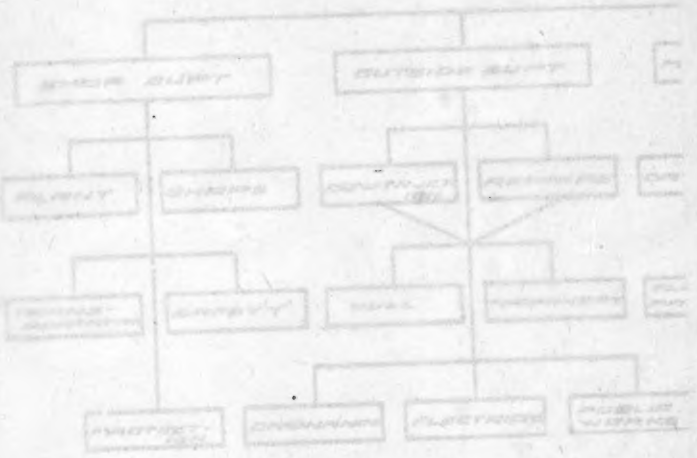


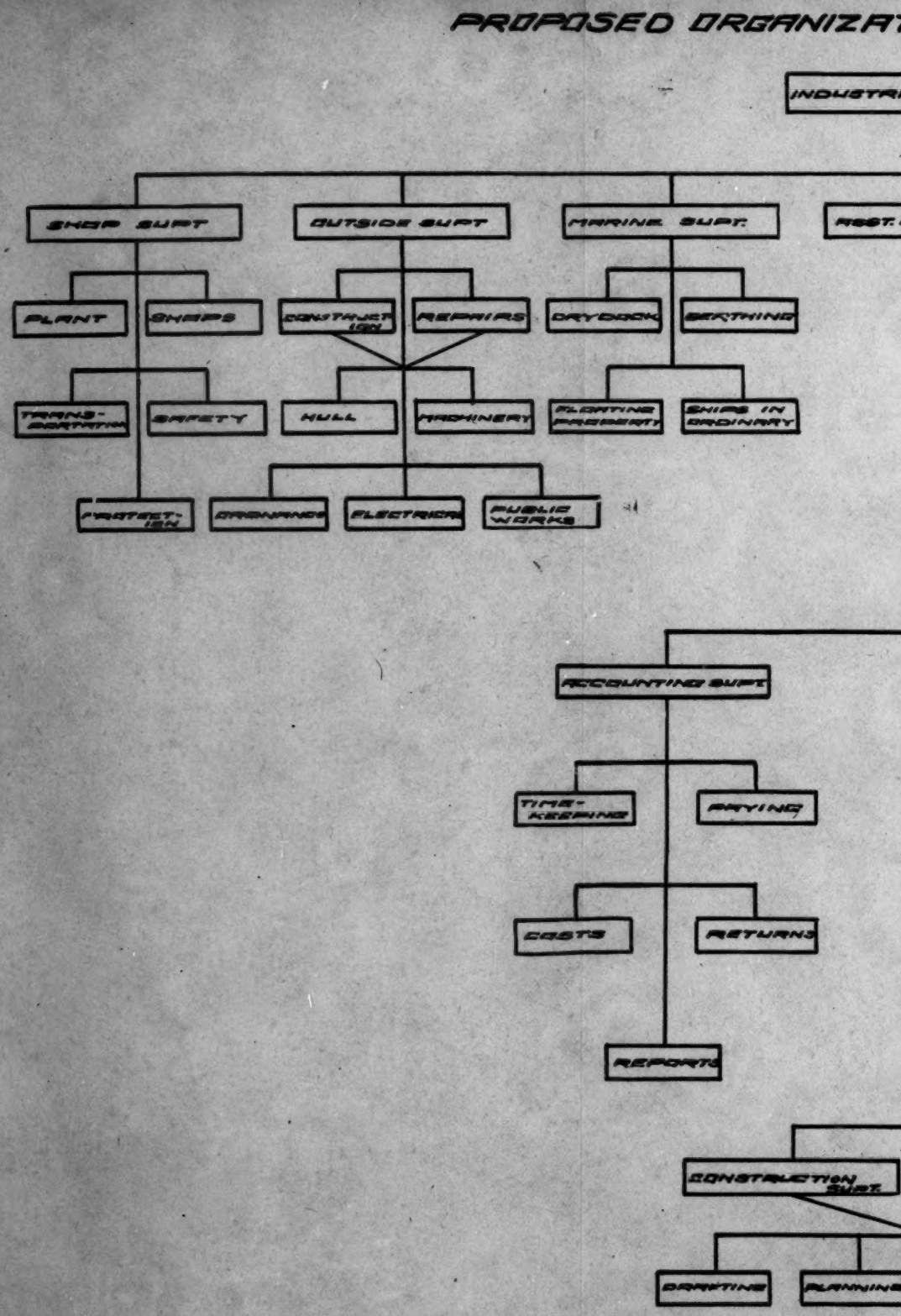
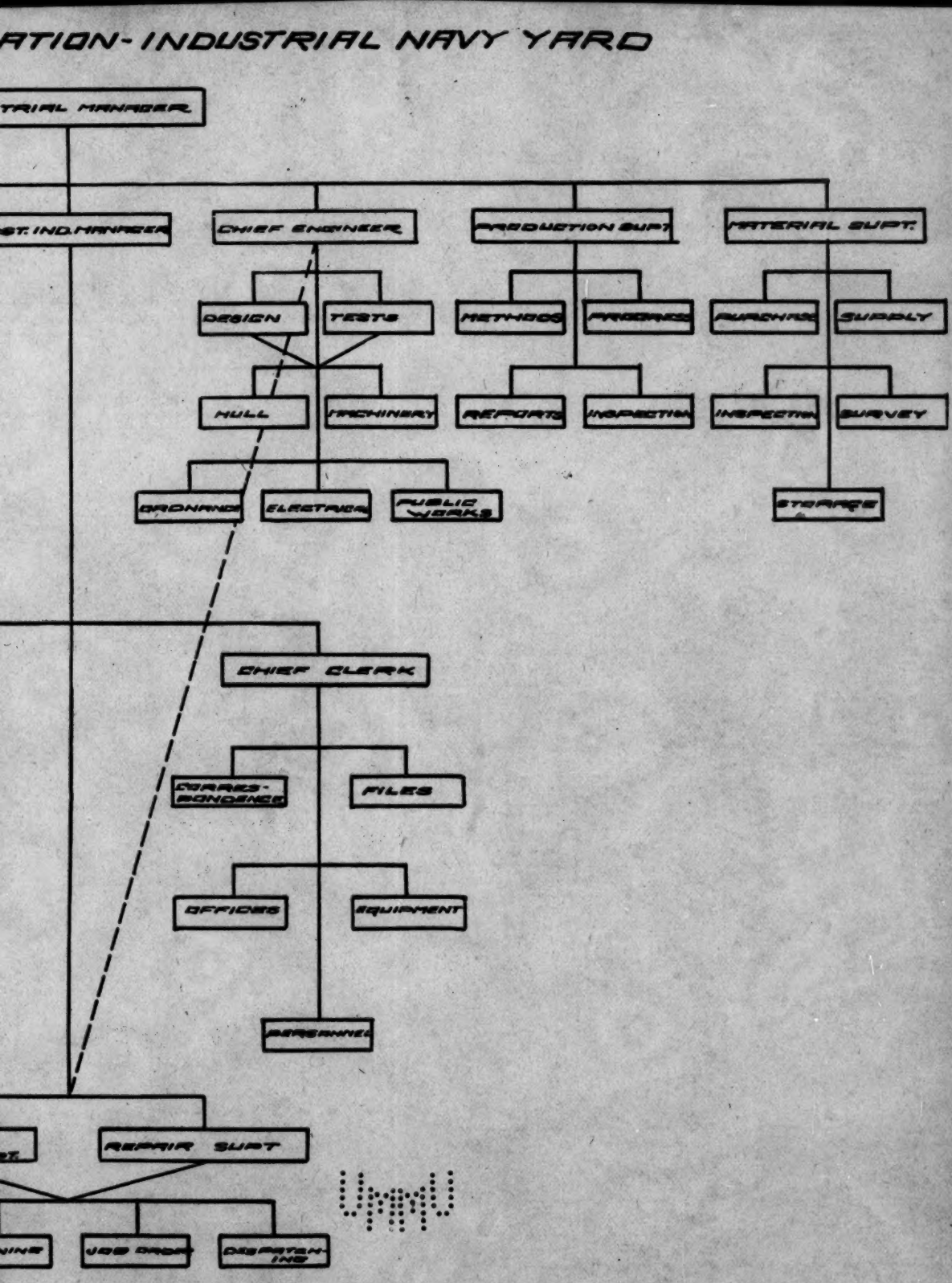


FIG. 1.—Proposed Orga



Organization Industrial Navy Yard.

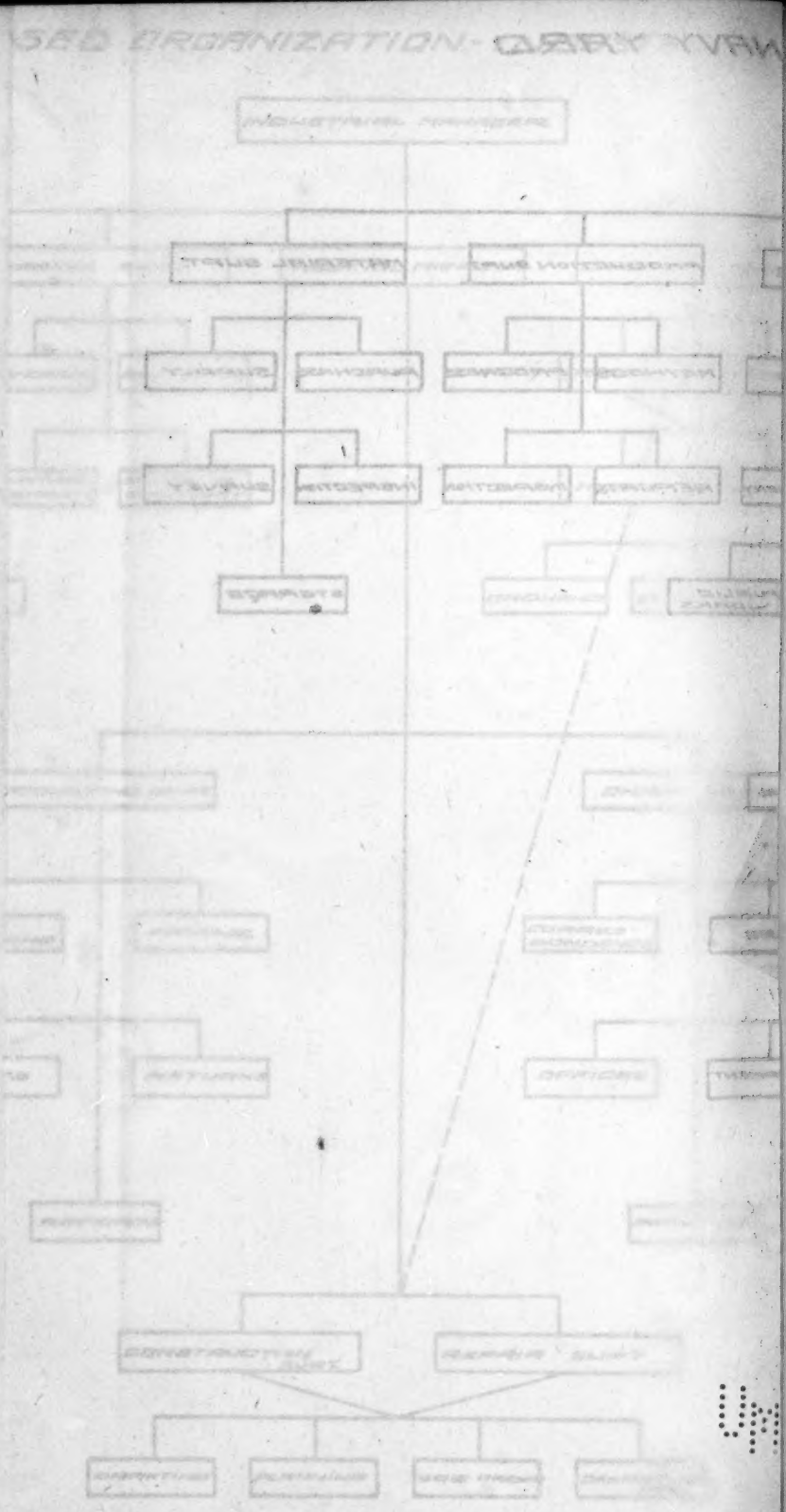


FIG. 1.—Proposed Organization Industrial Navy Yard

28. The commandant has under him to assist in handling the industrial matters under his "command," the various heads of divisions or "yard departments," each functionary being painstakingly and redundantly appellated as an *officer—i. e.*, "engineer *officer*," "construction *officer*," "supply *officer*," etc In turn each of these has his assistants who are the real superintendents directly in responsible charge of work. And if the first specification of the first charge was found "proved," or even "proved in part," as regards the general inexperience and lack of training of the commandant for his industrial duties and responsibilities, what then can we say in defence of the selection methods in vogue for the selection and assignment of these invariably numerous assistants of his?

29. Some of them in the higher grades doubtless may have had a tour of duty or two ashore in some navy yard, or as "inspector" of materials or machinery under one of another of the bureaus of the Navy Department, being stationed at some steel works, electric manufacturing company or shipbuilding plant. But in the majority of cases these officers were not selected in the first instance because of their especial fitness for industrial work, nor did they have any real opportunity to display such fitness or to acquire the necessary experience while occupying these previous positions. The question which immediately arises namely, "Where shall these officers secure this experience?" will be answered later in this article by a suggestion which though it may sound radical to-day, was at one time tried out in the naval service in the case of two officers.

II

30. Criticism, to be of value, must be followed by constructive suggestion. Holding his breath, therefore, the author now takes the icy plunge, praying the shooting will not start at least until he hits the opposite shore. Let us start with the first essential, the *personnel*, and sketch out an organization chart, then unfold some ideas as to the qualifications required to fill the various billets whose authority and responsibility are shown.[1]

[1] Strictly speaking, an organization chart of this character should start at the root of many of our evils, namely, the Navy Department itself, but the writer has felt that enough discussion and fireworks can probably be initiated by this proposed change in navy yard administration, without searching any further.

31. At the first glance, many of the readers will notice the complete absence of the word "*officer.*" The fact that some of these divisional heads may happen to be officers does not warrant proclaiming the fact blatantly by sign and signature. Nor has it anything to do with their duties in this organization. The author has worked both in military and industrial organizations, in uniform and in "cits," and has no hesitancy in stating he considers a uniform a distinct handicap in industrial work. Contrary to the popular military belief, it gives no special prestige or standing to the wearer in the eyes of his civilian subordinates, except to arouse a certain suspicion that if the brass bound coat and cap came off there would be but little left to worship and admire. So each head and sub-head has been given the title of his job only, without the intrusion of any word to lend the increasingly offensive military flavor.

32. It will be noted that the organization is grouped under an industrial manager, and divided into seven main activities, namely: (1) assistant industrial manager; (2) chief engineer; (3) shop superintendent; (4) outside superintendent; (5) production superintendent; (6) material superintendent, and (7) marine superintendent.

(1) *Assistant Industrial Manager.*—Flanked by the various principal superintendents and the chief engineer, who is the chief technical adviser of the industrial manager. The assistant manager is given charge of the *offices* proper, all office activities being under his division, including the accounting; the accounting superintendent has under his charge the *paying*, which is in accord with standard industrial practice and is entirely logical.

(1a) The relations between the assistant industrial manager and the chief engineer must necessarily be close since the repair and construction superintendents, respectively, will be in constant touch with the chief engineer and his assistant engineers as regards many points of design, planning of work, use of available tools and materials for special jobs, etc.

(1b) It is intended that the *repair superintendent* shall have complete charge (under the assistant industrial manager) of all drafting, planning, job order and despatching activities on ships under overhaul, repairs to yard plant, public works, repairs and maintenance, etc., whereas the *construction superintendent* shall exercise similar jurisdiction for all *new construction.* In other

words, these two executives will be responsible for the plans, the estimating and planning of all work, issuing of the proper job orders covering it and the despatching of these orders in proper sequence when the drawings and materials (and in some cases jigs and tools) are available. This arrangement is, of course, elemental in management work, and simply means that the shop, outside and marine superintendents and all their subordinates have nothing to worry about except the proper *performance* of the work in accordance with the drawings, *detailed* job orders, and material provided for them.

(1c) The chief clerk (a civilian, not an *aide*, "junior," "senior" or plain without trimmings) is properly made responsible for and given the requisite authority over, the whole clerical force, janitors, correspondence, files, equipment, civil service classified (non-technical), etc. The higher supervisory clerks in most navy yards are a long-suffering, overloaded, underpaid body of potentially able men, thoroughly versed in their jobs, and constantly prevented from using their experience and knowledge to the best advantage to the government.

(2) *Chief Engineer.*—In charge of all matters of design, tests, technical reports, etc. On his staff would be ordnance and electrical experts (both radio and gyro), a qualified constructor and civil engineer. As stated above, his relations with repair and construction superintendents would necessarily be very close. He would have no authority over the working forces and would not act as manager in the absence of the manager and assistant manager.

(3) *Shop Superintendent.*—All work *inside* shops, power plant, buildings, quarters, etc., also in charge all land transportation facilities, operation, repair and maintenance. The safety engineer and the police and fire heads are also under him.

(4) The *outside superintendent* handles every yard job outside shops and buildings, and all ship work. He has assistants for hull, machinery, ordnance, electric and public works activities.

(5) *Production Superintendent.*—Responsible for efficient methods of work performance, for "progress" and "follow up" reports, also for proper carrying out all tests and inspections of work done (as prescribed by plans and job orders or specifica-

tion requirements). As he must check work of other division heads, he reports direct to industrial manager.

(6) *Material Superintendent.*—To handle preparation of requisitions direct from plans and material lists, conduct purchasing, storage, and supply of all materials, machines, tools, supplies, equipment of every kind used by the industrial yard; to maintain automatic follow up records of status of every requisition, purchase order, contract, etc., and to accept full responsibility for *securing* and *delivering on time* every material thing required by the Industrial Department. He also is charged with the *survey* and *inspection* of materials. The maintenance of elaborate "material office" organizations by Hull, Machinery or Public Works Departments has no place in this proposed re-organization. All of their activities are properly functions of the material ("supply") division and the latter should be given this responsibility together with the organization to handle it.

(7) *The Marine Superintendent.*—In charge of dry docks, berthing, of ships, floating property (tugs, lighters, launches, floats), of berthing facilities, and ships "in ordinary." He moves vessels on waterfront to suit convenience of outside superintendent, upon request of latter, but never without informing him in advance. In the proposed type office building (Fig. 1), it will be noted that the office of the marine superintendent is close to that of the outside superintendent with whom he should consult in regard to berthings, dockings and undockings.

33. In discussing the above assignment of duties and responsibilities, before passing to the third chapter of this paper, the author believes the scheme once proposed by Commander L. M. Cox (C. E. C.) has great merit, *i. e.*, to have an experienced civil engineer on the staff of the commandant of each naval district, with a view to making the technical knowledge and experience of this officer available for consultation and recommendation on all major public works problems arising in any naval plant in the district. This scheme would not only relieve these technical officers of such petty worries as the re-furnishing of "chamber No. 111 in senior aide's quarters," but would also insure an unbiased, extraneous judgment to be applied to many of our yard development and construction problems the solutions for which are now unluckily, but nevertheless surely, influenced by

the warped viewpoint of "the man inside the fence," who is bound to be swayed by the many petty local considerations.[3]

III

34. Having our proposed organization before us, how can we select, train and assign the personnel available, so as to fill these positions satisfactorily? Let us start with the manager and build down from him.

35. It will be admitted that, to be a successful manager of any industrial plant of the size of the one under consideration, *i. e.*, a navy yard employing 8000 to 12,000 men (and women), a man must possess certain outstanding qualifications. Among these are: (1) education; (2) training; (3) experience; (4) tact; (5) energy; (6) initiative; (7) health; and (8) vision.[4]

(1) *Education.*—This does not mean solely the possession of a degree of diploma from a school, college, or university. Some of the best executives in big industry never had an academic education. But this man must be *"learned"* in his job, *i. e.*, he has kept in close touch with the advance in management, not only by professional reading and study, but by contact with other men in industry and by observation of their plants.

(2) *Training.*—The best executives are *"trained"* men. They have been through the lower positions in turn and have not, like a favored son, been pitchforked into one of the higher places, sooner or later to fall to their proper levels.

(3) *Experience.*—The broader the field of activity in which a man has served, if he has made the most of each opportunity to *grow*, the more valuable does this quality of experience become. Judgment comes only with experience, and our candidate must have judgment for he will surely have many opportunities to exercise this quality.

(4) *Tact.*—Here is a qualification that sometimes appears almost incompatible with some features of a military education

[3] Another point is that in any government establishment, politics and policy always will hold joint sway, so such matters as discipline, employment welfare, etc., except merest routine, must be handled in person by the manager or assistant manager, whereas in a big private plant, a separate office would handle these matters and the manager would see only the exceptional cases.

[4] I have not mentioned "honesty" since, like bravery, it is a quality we are warranted in assuming that every officer of the U. S. Navy possesses.

and training. Neither the rendering nor the *compelling* of absolute obedience, particularly the latter of the two, is an especially good school for *tact*. It is one of the most serious and fatal defects in the majority of our navy yard executives to-day. Tact implies patience, the quality of tolerance, of self-control at all times. It is of supreme importance in the handling of civilian personnel.

(5) *Energy*.—The author will have difficulty in getting by the censor when he remarks that, in his opinion, the average naval officer on shore duty shows little of this quality in comparison with his civilian brethren, nor even with his sea-going self. Most sea-going officers, regardless of corps, regard a tour of shore duty as a sort of mildly educative holiday; a chance to be with one's family, to renew friendships, to enjoy "all night in" with delicious monotony, to eat home food if married, and to taste the flesh pots of Babylon, if not. Incidentally, to acquire some experience about which he is rather vague as to its value in detail, but expressed only as a glittering generality this *value* is immense. The principal reason for all this state of mind is that sea-going, not shore-staying, is a naval officer's job and he knows it, added to which is the fact that the establishment where he is pushed into the organization, unfortunately doesn't have to show a profit. This latter condition is also responsible for that lack of burning zeal conspicuous in the most of us who remain more or less constantly on shore, so that altogether our navy yard officer output per standard working day is way below normal for an industrial plant (for corresponding executives).

(6) *Initiative*.—By this we imply the ability to take responsibility, to inaugurate improvements, the faculty of blaspheming, not worshiping, the little god of "things as they are"; in other words, the constant striving for improvement in all men and matters under this executive's charge, at the same time exercising that tact and judgment which the possession of initiative also implies.

(7) *Health*.—Our ideal must not only have health in the sense of freedom from illness, but must have the *vigor* to give real driving force to the energy we have prescribed for him. Mental as well as physical health is included here; he must not *worry*, but be alert at all times.

(8) *Vision.*—This implies ability to grasp not only the details of the job, but also the possibilities, the improvement to be had in personnel, in shops, in methods, in plant. The power to see beyond the desk and the office door, to look ahead, to anticipate. It has been named last as being the most important of all.

36. Now that we have these eight qualities enumerated, how should we go about training our future department heads and managers to insure their possessing the largest number of these qualities and the highest degree of perfection in each? The author would offer the suggestion that an industrial corps be established to comprise picked officers, from the line, construction, pay and civil engineer corps, who have distinguished themselves in handling industrial work, and who volunteer for this duty. If each of the five bureaus concerned nominated a representative to a board, and this board, under the presidency of the assistant secretary, selected say thirty officers from lieutenant commander to captain in rank, regardless of grade, simply on *record, reputation* and the *eight qualities above*, a nucleus for the organization of four first class navy yards could be formed. Select a manager for each yard from the thirty, *regardless* of *rank* or *corps*, and have the assignment to the industrial managership carry with it the rank, pay and allowances of rear admiral. This latter suggestion is almost solely an attempt to provide for the officer selected for this responsible position, a salary somewhat higher than the average piece work and "make up" earnings of the modern riveter or shipfitter, first class. The author was strongly tempted to suggest that these 30 should, from among themselves, elect by mail ballot, the four managers, but this would smack too much of "government by the governed" for a military organization, even in these piping times of universal suffrage.

37. The cry will be raised that bureau and departmental and corps politics and "pull" will be exercised at once by this or that candidate and bureau, and thus defeat the very object which is sought by this procedure. The answer to this cry is simply that the author claims no omnipotence of mind which makes it possible for him to wipe out our old scape-goat "human nature" at a stroke. The fact that influence has been, is constantly, and always will be used should not move us to damn all selective methods. The plain facts are that the present system of providing officers

for industrial duties is unsound and highly inefficient, resulting in a modern miracle if the rightly equipped man is fitted to the job, whereas the proposed method is believed to offer at the least reckoning, more than an equal chance that a qualified man *will* be selected.

38. Having provided a manager for (at least) each of the four large yards, let each in conference with the department select his principal assistants from the remaining eligibles. In selecting these, a prospective manager can be trusted to assign them to those supervisory positions in the organization for which their records show they have had the most experience. Next circularize all officers of these four corps above mentioned, of the rank of commander and below, as to their desire to take up industrial work; turn these applications over to the board which selected the nucleus of thirty, and let them choose an additional two hundred officers. (Of course, this selection must be balanced, *i. e.*, there should not be a preponderance of constructors at the expense of pay officer, etc., or a dearth of civil engineers for the requisite public works functions of the four yards any more than in selecting the first 30.)

39. When the list has the department's approval, order a sufficient number of these officers to fill the necessary quota at each of the four yards in the higher supervisory positions only, leaving the lower positions (assistants) for junior officers of not less than two years' sea service who apply for this duty. Those of these latter officers who show aptitude and desire to continue, at the end of one year should be given special technical courses, similar to that now established for the construction corps, for example. (It is assumed that the majority of officers will all now be drawn from the Naval Academy graduates in view of the large classes now available.) The remaining officers of the 200 should be given at least a year in industrial engineering at an approved technical school, with plenty of opportunity to study the various types of management in private organizations, and then sent to the yards to relieve those first chosen, who in turn should receive these special one-year courses.

40. In all of these technical courses, whether civil, electrical, mechanical or naval construction, especial stress should be placed in the last year on the importance of industrial engineering, management, and business economics. When the course is satisfac-

torily completed, notation should be made on the officer's record and in the navy register, and he should be ordered to one of the industrial yards, "for such duty as the manager may assign." During his first year in the yard, the junior officers (students) should be put through shop courses as was formerly done for all army ordnance officers, and as is now being done with assistant constructors.

41. At New York and Mare Island, for example, actual manual work in the various shops throughout the yard, is being performed by each student officer both as a helper and as a mechanic in all trades. The advantages of this training are so apparent that it makes many of us who have lost the thatching off our respective roofs, wish we had been given such a training back in the days when we were supposed to be securing our "practical education."

42. When the neophyte has finished his years' novitiate as proposed, he is available for assignment to one of the positions as assistant to a superintendent. For example, if he was educated (in the P. G. course) with an especial view to *civil* engineering, he would be detailed first to the outside superintendent, next to the assistant industrial manager's staff, and from here on his work would be along civil engineering lines. On the other hand, if educated for electrical engineering, he would go to the outside superintendent or the shop superintendent first for a tour, next to the repair or construction superintendent. Either of these would be available for assistants to the chief engineer after completing service in the above divisions.

43. The governing idea of this order of duty is that no one shall be in a position to design, plan, or issue orders for performance of work, until he has had actual practical experience in the doing of the work, either in the shop or outside, and preferably both. No officer should be detailed as assistant to the chief engineer (after those trained become available) until he has had experience in the office, shop *and* outside.

44. Now for the radical suggestion referred to in paragraph 29: Some of the two hundred officers first selected for assignment to the four yards to be placed under the industrial managers, that are not needed for the first detail, might be given leave to temporarily associate themselves with any approved private corporation where they could obtain first-hand practical experience

of the management game, to be recalled to duty as their services are required. This proposal requires a modification in the present law covering officers being employed by private firms holding government contracts. Also, no officer should be accepted for assignment to this industrial corps until he has signed an agreement to serve at least eight years (as is done by officers selected for the construction corps).

45. It is further suggested that every one of the officers selected for this industrial work, shall, as opportunity presents, be sent to sea for at least one year out of every five, excluding, of course, the first five after assignment to this shore duty. Each officer should be ordered to duty on board ship in that department for which he is to supervise work on ships when he comes ashore, such as steam or electrical engineering, ordnance, or naval construction. The groove into which the pay officer would fit is self-evident, but the civil engineer presents difficulties. However, the author hazards a guess that the sea-going would be good for this officer, and in any case he could be no more of a menace as an assistant to the chief engineer, the electrical officer, or the navigator even, then the junior lieutenant who springs, full-armed, into the job of outside superintendent under our present scheme.

46. A military organization of any kind that is to endure as an efficient unit, must be knit together by strands of common sympathy. This desirable state of understanding and appreciation can only be produced where we know each other's mode of life, its hardships, joys, and daily tasks. We shore-staying chaps are singularly free from a proper knowledge of our sea-going brethren at *work*. We are like the "*sub-deb*" who thinks the navy is just one delightful round of teas on the flagships, dinners, jazzy dances on the spotless decks with immaculate officers in glittering gold (?) trimmed uniforms, etc., etc. Therefore this article raucously insists that the author and all his confreres living in large crystal houses, be sent out to respond in kind to the mighty heavings of the ocean deep. The few months consumed will be well spent in the all around *esprit de corps* resulting, to say nothing of the broadening of the vision.

47. In our industrial manager scheme of organization there is no room for boards, courts, signal or communication watches or other strictly military assignments. These should be handled by the military commandant entirely, who should be the naval district

commandant and have entire charge of all *military* activities, with a proper staff to assume these responsibilities.

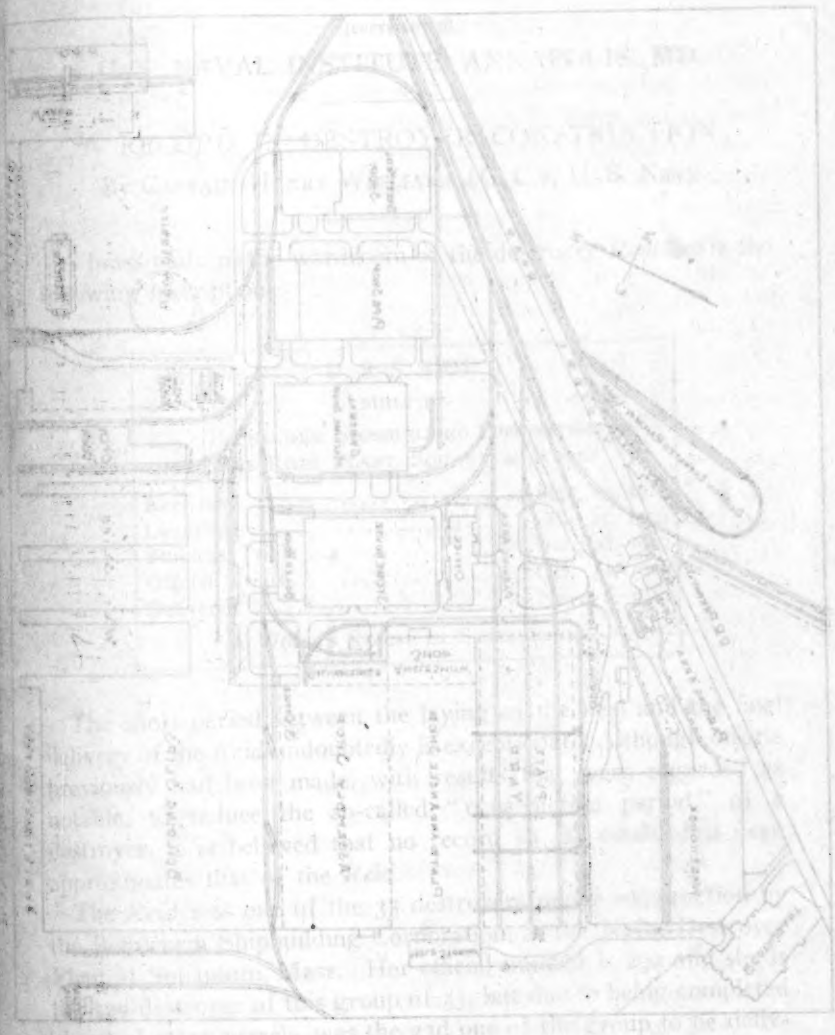
48. While serving out this panacea for all our navy yard ills, let us add another drop and suggest an inspector-admiral bureau or office, in the Navy Department, responsible to the chief of naval operations. Give it any title you please, it will be as popular under one as another. But no one can deny that there is a *screaming* need for *independent, thorough, efficient* and *repeated* inspection of all departments and divisions of our navy yards. (Bureaus and offices might well be included.) Do not assume by this that the restoration of the inspection officer and his crew is meant; far from it. An adjutant and inspector general's office under the chief of operations, with properly qualified officers from all corps, detailed for four years only, is intended; to embrace the boards of inspection and survey, prison boards, inspector of pay (supply) corps, etc.; and to have power to inspect the same as the adjutant general of the marine corps has for his corps, to report in detail, all findings, and submit recommendations, with of course, comment by those interested. The author is only interested here in the application of this inspection to navy yards, but its extension to military activities and to the navy afloat, has, in his opinion, advantages just as obvious. Such a bureau as this would make it possible to do away with many of the multitudinous boards ordered on every occasion by every one in authority in the navy. "When in doubt or fear, order a board."

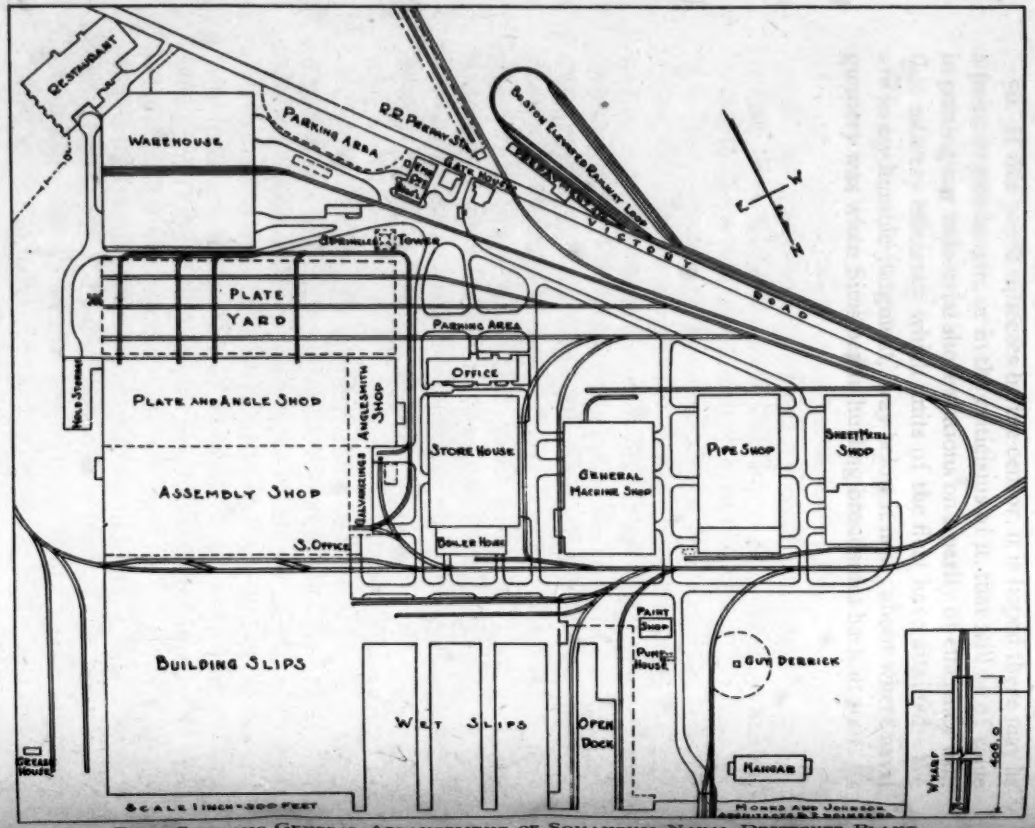
49. In conclusion, the author desires to placate those infuriated officers whom he has in the preceding pages, condemned to sea for life.[4] His scheme for this is regular uninterrupted two-year tours of duty in the *reserve* ships, officers to be so detailed as to rotate in day's duty on board, to draw sea pay and commutation of quarters, to be required on board only during drill hours (except when on day's duty). This gives the officer an opportunity to establish a home and allowances to maintain it, all of the leisure that a shore job *should* give him, and yet does not inflict him temporarily upon an organization which doesn't need him and which regards his entrance and exit respectively, not as events, but merely as part of

[4] Those on their three years sea duty on "active" ships, would be expected and required to exercise a thorough and painstaking inspection of every activity of the yard force on board their respective ships. The *idea* now exists, but the *practice*, in most ships, is a little bit pale.

the routine of the plant. This does not, of course, apply to those who seek detail to the Naval Academy, inspection duty, or assignment to the various bureaus in Washington or to special offices throughout the country.

50. If this paper squeezes by the censor, it is hoped there may be a point or two herein, or in the criticisms of it, that will be of value in putting our industrial shore stations on a parity of efficiency with that military efficiency which units of the fleet have attained. We are in my humble judgment, 'way below it now; about where naval gunnery was when Sims began hurling broadsides back in 1901.





PLAN SHOWING GENERAL ARRANGEMENT OF SQUANTUM NAVAL DESTROYER PLANT.

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U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

A RECORD IN DESTROYER CONSTRUCTION

By CAPTAIN HENRY WILLIAMS (C. C.), U. S. Navy

A brass plate in the wardroom of the destroyer *Reid* bears the following inscription:

"U. S. S. REID"
BUILT BY
BETHLEHEM SHIPBUILDING CORPORATION
FORE RIVER PLANT, SQUANTUM WORKS

Keel laid	Sept. 9, 1919
Launched	Oct. 15, 1919
Builders Trials	Oct. 28, 1919
Official Trials	Oct. 31, 1919
Delivered	Nov. 6, 1919

A WORLD'S RECORD IN SHIPBUILDING

The short period between the laying of the keel and the final delivery of the *Reid* undoubtedly is exceptional. Although efforts previously had been made, with results that were regarded as notable, to reduce the so-called "construction period" of a destroyer, it is believed that no record so far established even approximates that of the *Reid*.

The *Reid* was one of the 35 destroyers under construction by the Bethlehem Shipbuilding Corporation, at the Naval Destroyer Plant at Squantum, Mass. Her official number is 292 and she is the 32d destroyer of this group of 35, but due to being completed ahead of other vessels, was the 23d one of the group to be delivered. The contract for these particular destroyers called for 45 in all; 10 of them were built at the Quincy Works; the last one of this group of 10 was delivered Sept. 23, 1919. From the

PLAN SHOWING GENERAL ARRANGEMENT OF SQUANTUM NAVAL DESTROYER PLANT.

foregoing, it may be seen that, prior to the *Reid*, the builders had had plenty of experience on destroyers of this design and they were thus enabled to make the necessary disposition of men and equipment, assemble all needed material, and make certain that no delays would arise from lack of preparation.

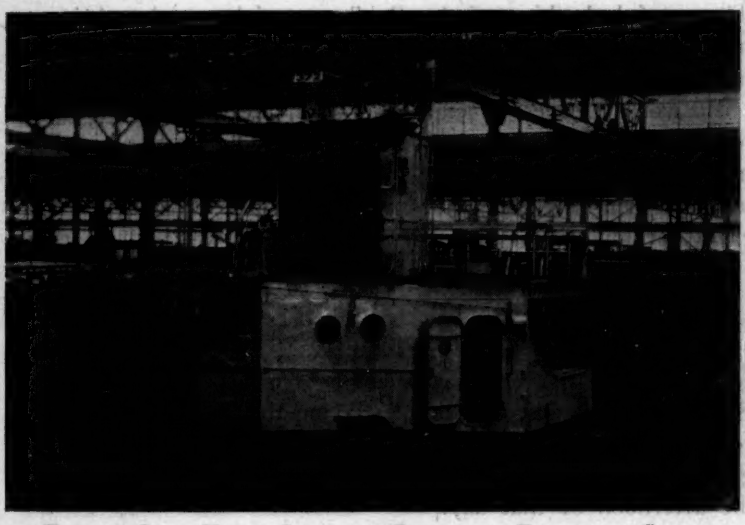
Through the expeditious building of a ship, the shipbuilder derives many advantages. The one generally regarded most highly is the publicity obtained thereby. Another, is the considerable economy, due to the intensive effort on the part of the mechanics and the consequent lowering in cost not only of that particular job, but of the work throughout the plant. Through stimulating the interest in such an undertaking, there is also a decided resulting improvement in morale and interest on the part of the workmen, who are apt to grow stale on so much repeat work, especially after the incentive of war is removed. As an offset to the advantages there is danger of slighting other work in favor of the record job. Also, there is danger of careless workmanship and unsatisfactory results. The latter can be obviated only by careful and thorough inspection and a rigid adherence by the inspectors to all tests and inspections and insistence upon the highest grade workmanship. In the case of the *Reid* it may be noted that during the constructional period six destroyers were delivered, five launched and work progressed on others. In other words, the work on the other vessels of the program proceeded at practically the normal rate. Furthermore, all the usual tests, required by the specifications and custom, were scrupulously carried out on the *Reid* and no deficiencies were waived. Inspectors were all warned of the necessity for unusual care and attention, and absolute compliance with the requirements of the specifications and test requirements.

Preparations in Advance of Laying the Keel

All of the structural steel material for the vessel had been put through the shop, "fabricated," to use a modern expression, some time previously to the laying of the keel. The 35 destroyers had been divided into four groups, three of 10 each and one of five. The structural material for each group was carried through the shop at the same time. Thus, framing for the last group of five destroyers, of which the *Reid* was one, was laid off, bent, punched, assembled and riveted, so far as was possible, all at one

time. Bulkheads were assembled and riveted. Keels, longitudinal deck girders and side stringers were assembled and riveted together in sections as large as could be handled. Shell plating of the *Reid* was punched in advance, except for 58 plates around the bow and stern, which were laid off from templates actually "lifted" from the structure, after other work had been assembled.

In order to avoid, as much as possible, congestion on the ship, and to expedite actual work, a number of sections or parts were



Forward Deck House, Including Bridge and Emergency Cabin Assembled on the Ground.
Note the apparatus and fittings already in place.

assembled and riveted together on the ground. This included deck houses, bridge, emergency cabin, searchlight tower, cofferdam and reserve feed water tank. These latter were assembled, riveted and practically completed on the ground before placing. Gun foundations including supporting bulkheads, deck and platform plating and stringers were assembled and riveted on the ground in advance. All auxiliary foundations were assembled and riveted on the ground. All machinery, including auxiliaries was collected, examined carefully and prepared for installation. Boilers were set up in assembly building, mountings and fittings

installed and the boilers tested hydrostatically, boiled out and cleaned. Smoke stacks were built, all piping cut to length and bent to shape wherever possible to do so. Careful steps were taken to ensure the readiness and satisfactory quality of all the material and fittings necessary. This had a double advantage, as it served not only to ensure the availability of the *Reid's* material, but indicated deficiencies in material for the other four destroyers of the group. In building a large number of vessels of the same design, there is of course, a tendency to replace material lost or spoiled on earlier vessels by taking that intended for later ones. The careful checking of the *Reid's* material served to bring to notice such deficiencies and was one of the reasons for building her out of turn.

No work in excess of eight hours per day was performed and only two shifts of men worked normally. On some special jobs, in order to avoid interference, a third shift worked. Some work, notably boring the shaft tubes, was performed on Sunday. Generally speaking, it may be said that the vessel was built, working two eight-hour shifts and with practically no Sunday work.

Work on the Building Slip

The keel of the vessel was laid at 7 o'clock in the morning, Sept. 9. In the first day, besides laying the keel, five bulkheads, reserve feed water tank and cofferdam were placed. The first gang of riveters was started riveting in way of boiler rooms in the afternoon of that day.

The following is a general summary of the work on the building slip:

Sept. 7. Keel laid and started riveting.
10. Erected stern casting.
13. Started fuel oil piping and drainage. Erected stem casting.
29. Shaft tubes passed water test. Struts erected.
Oct. 3. Installing sea chests.
6. First tanks passed water test.
8. Rudder hung. Some pumps installed.
10. Fuel oil and feed water heaters, remaining pumps, and ventilating sets installed.
11. Lines for shafting run and boring started.
12. (Sunday) Shafts installed and propellers placed by special gang.
14. First tank passed air test. Water testing of tanks completed.
15. Vessel launched at 4.30 p. m.

Work in Wet Dock

The vessel was towed immediately after launching to the wet dock and decks were cleared away for installation of boilers and turbines. All boilers and turbines were in the ship by noon Oct. 16, the day after the launching. Smoke stacks were placed Oct. 17. Final inspection of fuel oil tanks was made on Oct. 18 and 20, and 24-hour fuel oil pressure tests completed Oct. 22. Hydrostatic tests of boilers were begun Oct. 18 and completed Oct. 20. Spinning test of turbines and dock trial were held Oct. 22 and

A Destroyer Ready for Launching at the Squantum Yard. A door is opened, vessel is launched, another door opened and vessel put in wet dock under cover.

builders' trial underway, Oct. 28. The most remarkable feature of the whole performance lay in the short time required for the installation and completion of the boilers and machinery. To install, in so short a time, in the limited spaces on a destroyer allotted to boilers and machinery, a power plant of nearly 30,000 horsepower together with piping, fittings and electrical wiring, is rather noteworthy. The difficulties must be evident which attended the scheduling of all work on the vessel to permit the different trades to carry out their work in the various compartments without undue interference or delays.

Official four-hour full speed trial was held under direction of Board of Inspection and Survey, Oct. 31. At time of official trial the vessel was in a practically completed condition except for final cleaning, painting and post trial examinations and inspections. The vessel was delivered to the Navy Department completed so far as the builders were concerned, on Nov. 5.

A noticeable feature was the manner in which the interest of the men was awakened. The work was carefully scheduled in advance and free use was made of signs in the plant, giving date by which particular stages of the work were to be reached. Thermometers were used showing percentage of completion on the ship and in the wet basin, of all ships, and the interest of the men in the progress of the program was secured. This, as may be well understood, was one of the most important factors in the rapid completion of the work. In fact, when asked for an explanation of this really phenomenal result the plant superintendent replied, "Co-operation and team work."

THE RIVET DRIVE

During the course of construction of the *Reid* the number of rivets driven weekly is shown on the following table. It should be noted that the greater portion of the rivets were driven during the two weeks just preceding launching and in order to obtain this number of rivets without interference with other work, great care and judgment were necessary. At Squantum, as at other shipyards, the question of riveting was a serious one and, in order to obtain the weekly drive necessary, large numbers of new men had to be broken in. The table following includes only rivets driven during the building period and not those in bulkheads, keel, frames, etc., driven in advance of laying keel:

Week Ending	Number of Rivets Driven
September 12	11,603
September 19	35,518
September 26	52,109
October 3	161,486
October 10	142,514
October 17	45,379
October 24	31,366
October 30	5,062
Total	485,037

An average of 66 rivets per gang-hour was maintained up to the time of launching. Considering the number of men in the work and consequent interference this average may be considered as remarkably high.

The Squantum Naval Destroyer Plant

As the plant facilities contributed, more than any one other thing, to the expeditious carrying on of the work, a brief description of the shipbuilding plant seems in order.

In the fall of 1917, having in mind the congestion then existing in all shipyards, additional plant facilities were needed, in order that the construction of the 45 destroyers ordered from the Fore River plant of the Bethlehem Shipbuilding Corporation might be expedited. The contract, therefore, provided for special plant arrangements for the construction of 35 of them. A shipyard was built at Squantum, Mass., a boiler plant at Providence, R. I., and a turbine plant at Buffalo, N. Y. These plants were constructed by the Bethlehem Shipbuilding Corporation at the expense of the Navy Department and under its supervision, and remain the property of the government, their use by the contractor being limited to the construction of the destroyers in question. The reason for locating the shipyard at a distance from the Quincy works of the contractor and for separating the boiler and turbine shop lay in the necessity for opening a new labor market, that at Quincy being exhausted and the housing and transportation facilities being already much overtaxed.

Provision also was made in the contract for additional plant facilities, financed by the Navy Department, for the firms building the pumps, reduction gears and blowers.

The shipyard is located on Squantum Point, partly on the Neponset River and partly on Dorchester Bay. The tract of land, which is marshy, comprises about 700 acres, of which about 100 acres are occupied by the plant proper. The plant has a structural steel shop, assembly space, 10 building slips and six covered wet docks, all under continuous roof. The total area of the roof over these particular shops is about 18 acres.

There are in addition a pipe shop, sheet metal shop, machine shop, paint shop, electrical shop, riggers' shop, mold loft, power house, warehouse, storehouse and office building. There is a

large plate and angle yard, served by overhead cranes, adjacent to the steel shop. The material is laid off in lots for a group of vessels, and necessary punching, shearing, bending, planing and drilling are performed in the shop, whence it passes to the assembly space. Here it is assembled and riveted so far as is practicable on the ground and stored, pending erecting on the ship. When the ship is ready for launching a door in the house is opened, the vessel launched, another door opened and the vessel placed in a covered dock. The vessel is removed from cover only when necessary to install masts and hold dock trials. Practically all shipbuilding work is performed under cover and under cranes. In the assembly space, building slips and covered docks, there are a total of 42 electric travelling cranes, giving unexcelled crane service during all stages of the work.

The plant is connected with the Boston Elevated R. R. system by double track line and loop on the reservation. A bridge was constructed over the Neponset River and necessary street car tracks laid as a part of the plant. There is railroad connection with the N. Y., N. H. & H. R. R. at Atlantic station, and workmen's trains are run by the shipbuilder to and from this station to care for those men coming by train or living in the vicinity of Atlantic.

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WAR AND NAVAL ENGINEERING

By Lieut. Commander V. N. Bieg, U. S. Navy

In an effort to stimulate discussion, the writer has set forth certain points in connection with naval engineering which were noted during destroyer service in the war just ended. Consideration of this subject should be most profitable while occurrences are still fresh in the minds of those who performed engineering duties. Another endeavor in this article will be to show how intimately connected engineering designers and operators are, or should be, by purely military consideration, for there seems to be a sentiment in our service that engineering is less influenced by wartime operations external to it than any other branch of the service, or, in other words, that it is a profession apart.

What our service needs is naval engineers trained in the art of war, and not marine engineers alone. War experience and War College training in addition to purely technical training are vitally important for our engineering specialists, especially the designers.

The writer believes the requirement, that engineers have a thorough knowledge of war, is so important that there should be an engineer officer of high rank and long experience at the War College to give consideration to the location of fuel supplies, quantities necessary, the effect of known oil and coal fields on choice of naval bases, and influence of enemy fuel supply on their operations and our offensives; protection of oil and coal fields, best disposition for spares, patterns, stores, etc.; to keep the Office of Inventions informed of the nature of new developments required; to make up schedules of engineering casualties for war games with reasonable penalties for same; to learn the war game from A to Z; to study the effects of this and other wars on engineering design and practice and that of probable future

developments; to determine the missions for various engineering boards, bureaus, offices and officers, etc.

It can be only under the strong stimulus of such War College training that the impulse will come to project the mind into the future and to devise new methods, new designs, and to lay out the path that engineering minds should follow, in order to meet military and not engineering requirements, as such.

The magnitude of the necessity for many things cannot possibly be brought out any other way, and such training for engineers, or some of them at least, would certainly form a connecting link between those selected for engineering only and those not so detailed, which will enhance mutual confidence between these two groups and will prevent the creation of individual corps spirit.

Many subjects, new and heretofore given little, if any attention, have come to light during the war just over, and it is the search for still newer ones in the light of probable future developments which the War College course would stimulate and facilitate. For designers to direct their efforts along proper and profitable lines, some general outline must be at hand and a general object must be in view. The tremendous importance of good design, as the writer has in a previous article pointed out, is too little emphasized in our service. It is good design that wins out in the fight for economy, speed or whatever else we strive for, more than good management, although that, of course, is necessary, but at any rate in our service, this is almost universal and can be considered as routine and nearly a constant factor. But give the best manager or operator in the navy a poorly designed plant to work with, and competition with a well designed plant, only moderately well managed, is out of the question. Assuming that design is at all events important, there is no need for further expansion on its value.

Now given the necessity for certain requirements, good design and the inventive genius so marvellously developed along mechanical lines in the American, will, inevitably, fill the bill. Inventions and new arrangements proceed from necessity invariably, as surely as demand creates supply, and it is for this reason that the writer so strongly believes that this necessity, created in advance of actual requirements by the studies and games of the War Col-

lege, should be transmitted to engineering designers and kept up to date by a member of the specialized engineering personnel, who is stationed at the War College and is in intimate contact with all of its transactions. Invention has, of course, in some cases, been the outcome of some happy detached inspiration, but it more normally and frequently proceeds from logical and consequent demand for greater efficiency in some machine or contrivance already existent, in elementary or imperfectly developed form, in which the requirements of further development are, in a way, definitely known. The general trend of future development to meet our future military needs, then, is what the War College engineer member could and should supply.

As an illustration of the sort of thing that comes to mind in connection with a study of war operating conditions, and which could never proceed logically from a consideration of any portion of an engineering plant, from a purely engineering point of view, let us take the subject of the concealment of a large body of ships at night.

All officers who were at sea during the present war are familiar with darkening ship and the many deficiencies that were found to exist in the lighting arrangements in engine rooms, etc., when it became necessary to douse certain units, which before had been relied upon to light up gauges, thermometers, etc. And also every one realizes how much importance was attached to this subject. However, at that time there was no overhead observer to fear.

In the light of recent aerial achievements, this will, in the future, become quite an important point. The matter of shielding electric light is quite simple, but the glow from a white hot oil burning furnace projected up a stack can be seen in some types of boilers, and, whether or not this is serious, it serves to illustrate the point.

It will at once be seen that this is purely a matter of engineering design, but that the thought of seeking protection of a fleet by concealment would never logically enter the head of a designer, looking at the matter from an engineering standpoint alone. Hence it becomes evident that some outside influence must be brought to bear if naval engineering is to be what the name implies, and not simply marine engineering, and this influence can be and is believed best supplied by the War College through some engineer undergoing war training there.

In the discussion of some of the numerous occurrences and engineering matters presented here, an attempt has been made to bring out the military importance of them, as well as the purely technical side, and while these remarks apply in general to destroyer engineering only, they will serve to stimulate discussion and to promote the idea that a naval engineer is as much a military official as those officers in other departments of the navy, and will, it is hoped, militate against a great step backward, the segregation of engineers again into a distinct corps, by unwritten if not actual law; which at the present time seems probable and which will inevitably involve all the evils of the old corps system, which required many years to overcome.

The discussion of various matters, which came to the attention of the writer during the war, will now be taken up. As there is no logical connection between them, they are not given consecutively, but as they come, and each is independent of the other.

From a consideration of the number of times destroyers were late for convoys because of the failure of some minor auxiliary or were unable to make maximum speed for the same reason, it is believed that reliability should be the primary consideration, even at a sacrifice of great subdivision in units as a protection against total disablement and in the interests of economy. Instances are innumerable where it became necessary to send destroyers to sea with one or more blowers out of commission, for example. It is evident that maximum speed, which would most probably be needed in an engagement, could not be made in this condition. It is also extremely probable in the case of a ship as light as a destroyer that if damage were received in action, serious enough to disable a blower, so much other damage would be done in any one fire-room that other like units would not be able to operate and would no longer serve a useful purpose.

On many destroyers, the economy effected by running only one blower in a fire-room had to be sacrificed because of the necessity of being ready for a burst of high speed at any time, necessitating keeping all blowers in operation.

Subdivision at the expense of reliability has, it is confidentially believed, been carried out to too great an extent in our destroyers.

Subdivision, of course, is highly justified where, for example, three units are provided, any two of which may be used for full power, but this is more in the nature of providing spares, which, if valuable, involves much added weight.

Subdivision should, it is thought, be limited to two independent units in separate compartments, each as reliably built as possible.

In the case of blowers, it is confidently believed that one large substantially built blower in each fire-room with provision made for admitting air from one fire-room to the other by means of a watertight opening in the separating bulkhead will give a greater military return for money spent and weight allowed than a greater number of smaller and lighter blowers, as they are less reliable.

The *Trippe* fitted with two large horizontal blowers only, had no case of blower trouble in over a year of steady operation, in sharp contradistinction to other vessels fitted with four smaller and lighter blowers.

The elimination of the dependency on circulating engines in the present new type destroyer using scoops constitutes a good step in design, as the reliability of the arrangement of supplying circulating water is almost absolute, and it should be extended as far as possible to other types of ships.

Convoying large bodies of ships, whether merchant, supply or man-of-war, will surely be the lot of destroyers, to a great extent, in future wars as it has been in this war. The importance of being surely on station and remaining on station was brought out so forcibly from the very first that reliability was the paramount consideration. The relative values of reliability, economy and speed in our navy, it is believed, has been proved by the war to be in the order given.

Oiling at sea, is of course, an accomplished fact and a well recognized proceeding. During the process of oiling six destroyers en route to Queenstown from the *Maumee*, the following observations were made:

Capacity for supplying oil rapidly was insufficient. Slow speed of tanker and destroyers is, of course, obligatory while oiling, constituting a danger to both ships, and this period should be shortened as much as possible.

Oiling was accomplished by towing the destroyer alongside in the *Maumee's* lee, lines being run as shown in sketch, the destroyer making one knot less speed than the larger ship.

The oil lines, two in number, were rubber or rubber covered hose run from the side of the *Maumee,* the bight of which was supported by a line from a boom. It is considered that the boom was entirely too short and too light. Considerable difficulty was experienced in hauling the oil lines aboard, owing to the fact that the boom was too short to keep the oil hose from trailing in the sea, the speed of towing being such as to put a very heavy drag upon the hose. This fact also made it necessary to tow the destroyers too near the *Maumee* for solid comfort. Booms should be much longer and stronger and oil lines of greater size.

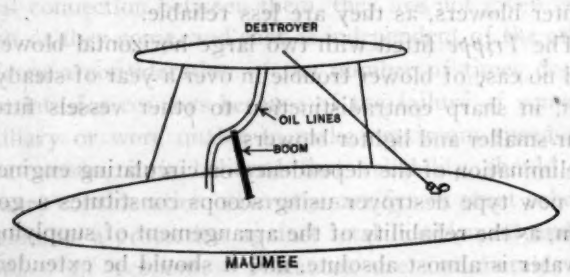

FIG. 1.

Constant operation at night strongly brought out the fact that our lighting arrangements are not too satisfactory. Especially is this true as regards illumination of fire control instruments and concealed lighting by which spotting data could be looked up, so that proper deflections could be sent to guns, etc. It is true that this data may now be obtained from a Ford Range Keeper, but even in destroyers as late as the *Dent,* there was nothing but makeshift lighting to illuminate the dial of this instrument. Lighting for such locations should be by storage battery, as the ship's circuit is too fickle under conditions of gunfire to be relied upon.

On the secondary or auxiliary lighting circuit supplied by storage battery should be included the bridge compass, the charthouse, the directorscope and Ford Range Keeper, the magazines and handling rooms, the steering engine room and a small portable light at each tube for use in making torpedo adjustments, or else

separate storage batteries should be provided for groups of lights for the above purposes.

Searchlights are not light-tight, but should be made so, in order that the light may be on and working properly, ready to flash on at a second's notice.

Lights in officers' desks and in the wardroom pantry and in all toolrooms, fore and aft, should be included on the battle circuits. During a night of running dark, it is certain that some papers or notes, etc., will be required, and coffee from the pantries is not a luxury, but a necessity.

Some dim lighting should be provided for illumination of fire- and engine-room deck operating gear in case of accident at night, preferably by auxiliary circuit storage battery. When this gear is to be used, it is certain that the personnel will be, to say the least, hurried, and fumbling about in the dark is not the best way to locate and operate valve wheels, upon which the safety of the ship depends.

Better hoisting and lifting facilities should be given repair ships. Booms should be heavier and longer. During the past war, there happened to be in our base ports an ample number of tugs available for handling destroyers incapable themselves of steaming alongside repair ships because of main engines undergoing repairs, so that boats not inboard against the ship's side, could be shifted if any heavy piece of machinery required lifting. This will probably not be true to the same extent in another war where our destroyers are operating at an advance base, and not from a permanent home base as they were in Ireland and France. Four boats on each side of a repair ship is about the limit, and booms should be long and strong enough to reach the outboard boat on either side.

Our wise and foresighted policy in regard to repair ships and self-sustaining qualities of our destroyer flotillas was more than vindicated in the war. It is not thought too much to say that the repair ships abroad more than paid for themselves in actual money saved, and in military value, almost paid their weight in gold. Without these ships, there could have been no convoy system, no extended patrolling, and our boats would have lain idle for months. There is not credit enough to give the officers who directed repair work on these ships, and certainly they should be rewarded for their extraordinary and effective work by the award

of the highest medals and honors. It has been conclusively proven that any amount of money lavished on this type of ship in the future will be spent to as great advantage as money can be spent.

A tremendous volume of work was handled by these ships, but destroyer operations in this war, owing to complete surface command of the sea by the Allies, was of so routine a nature as to lead to an erroneous conclusion as to the capacity of these ships for handling repairs. Such great volumes of work could only have been done because of the possibility of scheduling work. In wars to come, this will not always be the case, and more sudden demands for large volumes of work will be required as against a steady demand spread over a long time interval. This brings up the subject of greater repair facilities on the destroyer itself, except for repairs of a major nature.

All through the whole time of service at Queenstown, it was apparent that more facilities aboard ship should be provided. This will also be important where a sudden demand is made for work, even where a repair ship is present. A great deal of useful work, now impossible, could be accomplished if a suitable frame were provided for portable electric drills which would permit setting the drill to any angle and providing the drill with small milling cutters. This frame could very conveniently be situated near a boring mill table, and could with milling cutters be used in conjunction with it. As far as actual expense goes, these machines would pay for themselves in a very short time. Some method of handling work larger than can be carried in the lathes is absolutely necessary. A drill flexibly mounted, supplied with milling cutters in connection with a boring mill, would combine as far as possibility of work, a planer, shaper and boring mill.

En route to Queenstown, an incident happened on the *Trippe* five-turbine three-shaft arrangement, on which ship the writer later became engineer in addition to other duties, which brought out some interesting points in connection with accessibility of parts for repair and the tremendous importance of facilities for repair aboard ship.

About half-way between Boston and St. Johns, Newfoundland, noises heard in the starboard L. P. indicated that something was rubbing badly. This engine, together with the S. I. P. cruising on the same shaft, was immediately shut down. The

ship was in company and in formation with five other boats. The question of going ahead on the remaining two shafts was considered. This, of course, was done, but the point that is to be brought out is that the ship was forced to steam at a considerably lower speed than it was practicable to make, and hence, slowed down the whole six boats because of the fact that there was no shaft brake or clamp provided. Jacking gear was inserted to keep the idle shaft from turning and further damaging the turbine, and rope lashings were applied in a crude fashion around the couplings.

Some form of band brake should be provided on all ships for use in a similar emergency. The writer made a note of this fact at the time, and upon arriving in Ireland, found that in the British Navy this scheme had before then been adopted. The military importance is quite evident.

Upon settling down to new conditions, preparations were at once made for raising the turbine casing upon reaching port. The steam valve to the turbine was thought to be tight, the bolts were removed from the casing, and the exhaust trunk joints were broken. It is here noted that the section of exhaust trunk to be removed was *hinged,* an excellent arrangement which prevents the necessity for lifting out a heavy weight and which would have permitted this section to have been swung clear, while still underway even in rough weather. The turbine casing was also *hinged,* and the same applies to this arrangement. If it had been necessary or urgently desirable, it is not too much to say that the casing could have been raised at sea in this instance where the sea was very smooth. At least this hinging is important in the case of a boat where it becomes necessary to lift a casing when away from a regular base, and in the lee of an island, for example, where there was present a slight swell. This hinging, from a military point of view, is believed to be far superior to any other arrangement. With stout hinges and the chain-fall equipment supplied to our boats, there is not believed to be the slightest danger in connection with raising a casing, even with considerable motion on the boat.

Upon breaking the exhaust trunk joint on this particular trip, it was found that this section must be left not only in place, but that the joint had to be kept tight as the large valve between the M. H. P. and the S. L. P. leaked so badly that pressure was

accumulating in the condenser. This also necessitated the continuous running of the circulator for this condenser which should have been entirely isolated. The importance of frequent inspection and the tightness of all valves by which the condensers can be isolated was made painfully apparent. There was no repair ship at St. Johns, and repairing these valves ashore would have consumed much valuable time. If the ship had been forced to cross the ocean or to make a long trip in this condition, it would have been dangerously handicapped.

There should be facilities aboard each boat for cutting the seats of such valves. It is believed that an electric drill fitted with milling cutters and mounted on a revolving arm pivoted at the center of spiders placed across the valve seat would furnish a satisfactory and light device for taking cuts on the seats of large valves in place. It is also believed that if an adaptation of a light boring mill with revolving table and cutters arranged at its circumference were provided, cuts could be taken off large valve discs satisfactorily. This machine would allow also the machining of much larger pieces than can be swung on the small lathes provided. Referring again to the incident cited above, it was found upon lifting the P. L. P. casing that one-half the dummy strips were wrecked. These were chipped away, bearings shimmed up, the casing closed; and the trip across the ocean was successfully made. In this connection, it is confidently believed that the dummy strips should be caulked into both dummy piston and dummy cylinder, instead of having the piston dummy an integral part of the rotor. The damaged half of the rotor dummy strips on the *Trippe*, although steel, would not have operated satisfactorily, owing to irregularities, wear, etc., unless turned in a lathe. Separate strips caulked in would have permitted renewal by repair ship without the necessity of removal of the rotor from the ship. The dummies, of course, are damaged more frequently than any other part of the turbine, barring total wreckage due to loose blades or foreign articles, which damage cannot be provided against by design, purely.

Renewal of tubes in boilers was quite common, and only those types of boiler in which retubing can be accomplished without cutting out good tubes in order to insert new ones and without necessitating removal of boiler casings, should be adopted. Given

this type of boiler, many of which are in use now, there is no reason why dead boilers cannot be retubed while steaming at sea.

Bulkhead joints in steam lines should be absolutely eliminated. It is impossible to keep these tight on account of play in the light bulkheads, and if these leak, stores are ruined or personnel is inconvenienced. In all long lines of piping, either expansion bends or slip joints should be fitted, but anchor engine lines are not now so installed, even in late boats, and are a constant source of annoyance. Small expansion bends, of course, involve less weight than expansion joints.

A great deal of the damage to propellers could be prevented by a better type of propeller guard. This subject is now under consideration at the Boston navy yard.

All electric motors should be installed fore and aft. Much trouble was experienced with those mounted athwartship during heavy rolling.

Switchboards should be mounted well away from bulkheads which sweat and be protected from falling sweat by metal shields. They should never be placed near a porthole or hatch where spray can get to them, due to negligence in closing the port or hatch at sea.

One of the most frequent and serious causes of defection in ships from what may be termed the front line was condenser trouble. Time and time again, boats were forced to leave their posts and return to port on account of salting up. There is just one way that this can be prevented; rigid and frequent tests of condensers in port. They can be tested at sea after leaks develop, and this has often been done, but the vacuum test is the only one available, and unless the valves between the L. P.'s and the next turbine up the line are tight, even this will cause overheating of the condenser, due to leakage of steam and lack of circulating water.

The remedy, or rather preventive measure, resolves itself then into being able to frequently apply high or nearly the original specified test pressure to the tubes before steaming commences, that is, during overhaul periods in port. It is obvious that if the condenser tubes will stand, say 900 pounds to the square inch in pressure, they are not likely to give way due to corrosion for a further period after test of many months. Those which are found defective on test would either be plugged or renewed. By this method, defective tubes would be eliminated before they gave

way under steaming conditions with resulting salting up and return to port.

This test would also obviate the necessity in old condensers, when overhauled, of renewing all tubes instead of only those which are defective. The writer has designed, roughly, an arrangement by which this test can be made, and it is earnestly hoped that the department will develop either this scheme or some other, in order that "salting up" can never be given as a reason for quitting the sea. Instead of air pressure, hydraulic pressure might be applied, and in the case of a ship with condenser tubes of the same length, multiple test heads might be used. This test would not be required at very frequent intervals and could be made in several working days. (See Figs. 2 and 3.) In the case of packed tubes where ferrules are used: some arrangement of test head shaped like a plug could be inserted in the tube.

This apparatus consists merely of a fitting as shown at *A*, backed by a screw jack which fits between the tube sheet and condenser head. Air pressure is applied by compressor through flexible copper piping. One man at each end of the condenser would apply *A* and *B* to the ends of the same tube setting up on the jack by means of the hand wheels shown and forcing the rubber gaskets against the tube ends; another would turn the plug cock admitting pressure, and he would, after the gauge showed the pressure to be applied, shut off the cock. The rate at which the pressure fell would indicate at once any pinhole, split or rupture; or pressure could be applied to all tubes in order to rupture thin ones and the standard tests now in use applied later to discover and eliminate those tubes which have failed under high test pressure.

It is realized, of course, that the testing of a large condenser by such a method is long and tedious, but not more so than overcoming the effects of salting up a whole plant, and dependability of the condenser would, it is confidently believed, be almost absolute.

Economy at sea, over and above that obtained by careful operating and good engineering practice, is solely a matter of original design.

This would seem to affect in a major way only turbine and propeller design, as no combination of one small boiler for use at very slow speeds with other larger ones, could be devised to

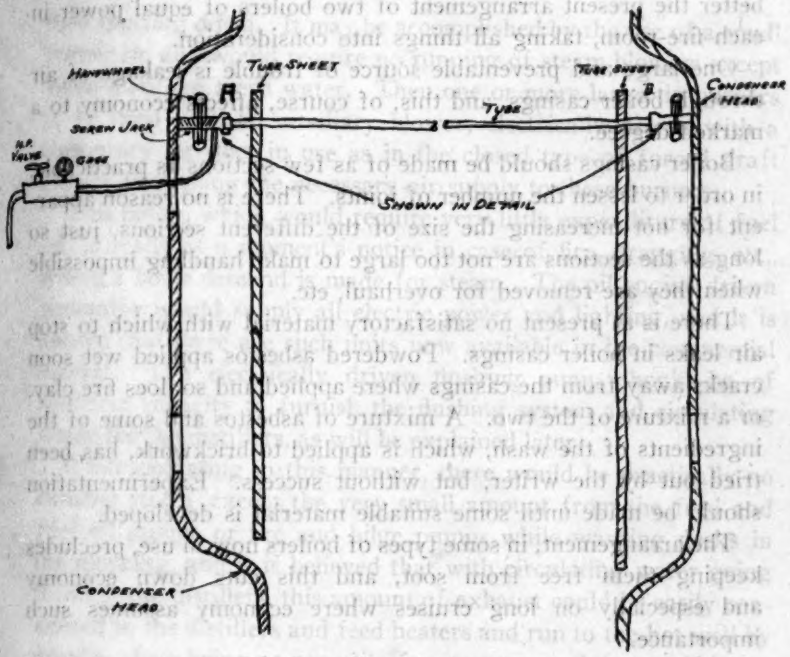
HANDWHEEL
TUBE SHEET
TUBE SHEET
CONDENSER HEAD
A
B
TUBE
SCREW JACK
H.P. VALVE
GAGE
SHOWN IN DETAIL
CONDENSER HEAD

FIG. 2.

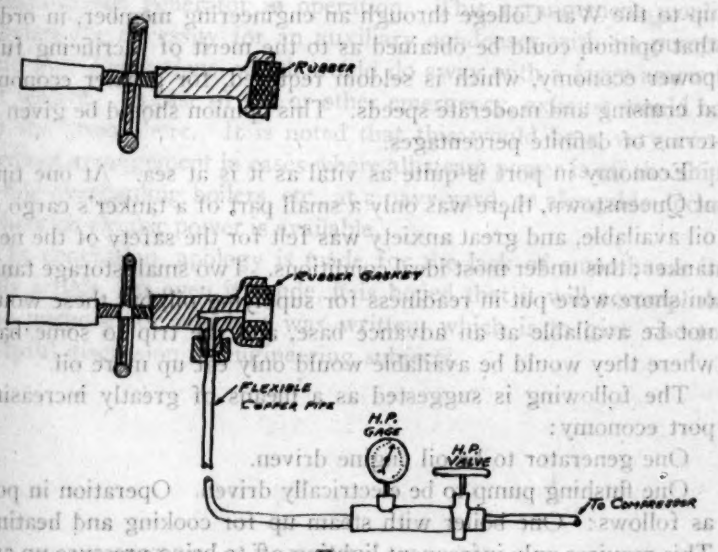
RUBBER
RUBBER GASKET
FLEXIBLE COPPER PIPE
H.P. GAGE
H.P. VALVE
TO CONDENSER

FIG. 3.

better the present arrangement of two boilers of equal power in each fire-room, taking all things into consideration.

One large and preventable source of trouble is leakage of air through boiler casings, and this, of course, affects economy to a marked degree.

Boiler casings should be made of as few sections as practicable, in order to lessen the number of joints. There is no reason apparent for not increasing the size of the different sections, just so long as the sections are not too large to make handling impossible when they are removed for overhaul, etc.

There is at present no satisfactory material with which to stop air leaks in boiler casings. Powdered asbestos applied wet soon cracks away from the casings where applied and so does fire clay, or a mixture of the two. A mixture of asbestos and some of the ingredients of the wash, which is applied to brickwork, has been tried out by the writer, but without success. Experimentation should be made until some suitable material is developed.

The arrangement, in some types of boilers now in use, precludes keeping them free from soot, and this cuts down economy and especially on long cruises where economy assumes such importance.

In regard to speed, it is believed that the matter should be put up to the War College through an engineering member, in order that opinion could be obtained as to the merit of sacrificing full-power economy, which is seldom required, for greater economy at cruising and moderate speeds. This opinion should be given in terms of definite percentages.

Economy in port is quite as vital as it is at sea. At one time at Queenstown, there was only a small part of a tanker's cargo of oil available, and great anxiety was felt for the safety of the next tanker; this under most ideal conditions. Two small storage tanks on shore were put in readiness for supplying oil, but these would not be available at an advance base, and the trip to some base where they would be available would only eat up more oil.

The following is suggested as a means of greatly increasing port economy:

One generator to be oil engine driven.

One flushing pump to be electrically driven. Operation in port as follows: One boiler with steam up for cooking and heating. This requires only infrequent lighting off to bring pressure up and

then shutting down. It may be accomplished by the use of a small burner tip and would require no running of steam blowers except when distilling fresh water. Then one or more large tip burners to be used with an auxiliary blower, electrically driven with a temporary air duct in use as in the closed type of forced draft blower furnishing the necessary air supply to these burners.

This boiler, which would require very little expenditure of fuel oil, is ready at a moment's notice in case of fire, dragging, etc., where a large demand is made for steam. The oil engine-driven generator would supply all electric power and lighting, and it is known that there are such units now available in the commercial market. The electrically driven flushing pump should be of sufficient capacity to furnish the flushing system and circulating water for the distillers, as will be explained later.

While operating in this manner, there would be practically no exhaust steam, except the very small amount from the feed and fuel oil pumps or fire and bilge pumps while washing decks in the morning, and it is believed that with circulating water going through the distillers, this amount of exhaust could be easily condensed in the distillers and feed heaters and run to the hot well by gravity, there being no necessity for vacuum, as there would be no steam-driven generator in operation. This arrangement would obviate the necessity for an auxiliary condenser with its pumps and pipe connections, which would do away with a large amount of weight. In case of fire or other emergency, exhaust would be to the atmosphere. It is noted that this would be a very convenient arrangement in cases where all steam power is off the ship while overhauling boilers, etc., at a navy yard, or alongside docks where no electric power is available.

In conclusion, apology is made for the lack of smoothness in this article, but even if crude, it is hoped that it will accomplish the purpose for which it was written, which is to give rise to helpful discussion of engineering subjects.

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U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

THE USE OF ALTITUDE AND AZIMUTH TABLES FOR THE OBTAINING OF LINES OF POSITION, IDENTIFICATION OF STARS AND GREAT CIRCLE COURSE

By Abner B. Clements

The Altitude and Azimuth Table, Table VI of H. O. 200, is a spherical traverse table, or table of right spheric triangles, and since right spheric triangles can be solved by Napier's rules, which are not subject to the same limitations as those for plane right triangles, this table may be used even more generally than the familiar plane traverse table.

The trigonometrical problem involved in determining the line of position or Sumner line from assumed hour angle and latitude and an observed altitude, is that of the solution of the astronomical triangle PZM to find the angle at Z and the side ZM, given the angle at P and the sides PM and PZ. The problem of the great circle course and distance is the same regarding M as the position left and Z the destination, or vice versa. And the problem of determining the hour angle and thence the right ascension of the star and declination is, given the angle at Z and the sides ZM and PZ, to find the side PM and the angle at P.

Line of Position

In the method of Lord Kelvin and Commander de Aquino the triangle PZM is divided into right triangles by dropping the perpendicular from M on the side PZ. It will be found more convenient to consider the perpendicular as dropped from the angle Z on the side PM. Then regarding the d of the table as the latitude, Z of the table as the position angle, and a and β as the

two parts of the azimuth, the rule for the use of the table becomes, using the notation of Fig. 1:

Where

t = Hour angle.
d = Declination.
L = Latitude.
h = Altitude.
Z = Azimuth = $\alpha + \beta$.
M = Position angle of observed body.
a = Length of perpendicular.
b = Declination of foot of perpendicular.
C = Distance of foot of perpendicular from observed body.

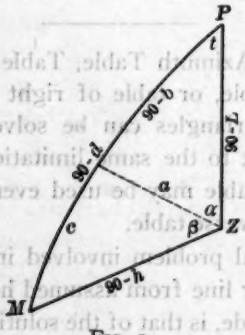


FIG. 1.

Rule.—$C = b - d$, β has the sign of C and $Z = \alpha + \beta$ and is always measured from the elevated pole regardless of sign, and to the east or west as the hour angle is east or west. When the hour angle is greater than 90° (six hours) use $180° - t$, and in that case use also $180° - d$.

Having obtained the hour angle from the observed time and the dead reckoning longitude enter the table and take out as plotting or assumed latitude and hour angle the nearest quantities to these, the latitude from the $L \setminus d$ column and hour angle from t column, opposite these take out b from left-hand column and a from right-hand column on same line. Obtain the plotting longitude from plotting hour angle and Greenwich hour angle and plot on chart. Compute C by subtracting the declination from b and run down the column C and find the degrees of C, on same line with this take

out β, h_1 and M. Compute Z from $Z=a+\beta$ and plot the line of bearing on chart and correct h_1 for the minutes of C by

$$h_c=h_1-\Delta C \cos M.$$

This correction may be taken from any table of plane right triangles, as Table 2, Bowditch, entering Table 2 with M as course and ΔC as distance and taking the correction from the latitude column, or may be obtained by dividing the minutes of C, ΔC, by the factor $\frac{60'}{\Delta}$ found between the values of h and M in Table VI. This correction is always subtractive.

The value of Z obtained from $Z=a+\beta$ is exact when the quantities used are found in the middle column headed a, and is sufficiently close for practical purposes in all cases, and the value of M is sufficiently exact for correcting the altitude.

Lay off the difference between the observed altitude properly corrected and the computed altitude just obtained on the line of bearing, toward the observed body if the observed altitude is the greater and away if the less and draw line of position at right-angles to line of bearing.

It will be noticed that three or four pairs of angles may be found in the tables, all near the dead reckoning values, any of these may be used, and these will give the same line of position, but determined from different plotting positions and different altitude differences. Where the dead reckoning position is found much in error where intersecting lines of position are used, the necessity of correcting the position by rectifying the lines of position may be avoided by choosing other angles giving plotting position nearer the intersection first found, thus getting greater accuracy as well as saving computation and the use of additional tables. Something of a check on the dead reckoning position may be obtained by noting the value of a, the perpendicular, which must be less than $90°-h$.

Example 1.—January 11, 1918, a. m., sextant altitude of sun's lower limb, 12° 10′ 40″ bearing S. and E.; W. T., $8^h\ 53^m\ 06^s$; C—W, $7^h\ 55^m\ 50^s$; C. C., $-1^m\ 55^s$; height of eye, 18 feet; I. C., +1′ 30″; approximate position, latitude 38° N., longitude 122° 16′ W.

SOLUTION IN DETAIL

	h m s		
W. T. obs. plus 12 hrs.	20 53 06	Dec.	=21° 51.8′
C—W	7 55 50	Corr.	.3
C. C.	1 55		
		Corr. Dec.	=21° 51.5′ S.
G. M. T.	4 47 01	b (p. 258)	=52
Eq. T.	7 56.2	C	=73° 51.5′
G. A. T.	4 39 04.8		
G. A. T. arc	69°46′ 12″		69° 46′ 12″
Long.	122 16		
Local H. A. $=t=$	52°30′ E.	Tab. H. A.	52° 16′ E. (p. 253).
$a=38°$ 30′ (p. 253).		Longitude	122° 02′ 12″
		Latitude	38 05 (p. 253).
Obsd. alt. ⊙	12° 10′ 40″		
I. C.	1 30		
Corr.	7 54		
h_o	12° 20′ 04″		
h_o	12 20.1	$a=$	51.8°
h_c	12 34.4 (p. 252).	$\beta=$	79.9
h_c-h_o	14.3′ away on line of bearing, $Z=131.7°$ E.		

With dead reckoning latitude $=38°$ and $t=50°$ 30′ look in table and on page 253 take out 38° 05′ and 52° 16′, the latitude and hour angle of the plotting position, and opposite them note $a=51.8°$ and $b=52°$, which, combined with declination 21° 51.5′, gives $C=73°$ 51.5′. Opposite C 73° 51.5′ by interpolation take out $h_c=12°$ 34.4′ and $\beta=79.9°$, then the difference between the true altitude and h_c is the altitude difference 14.3′ to be laid off from plotting position away from sun on line of bearing, $Z=131.7°$ E.

It will be seen that all this requires no computation, but will be done by the navigator mentally at one opening of the tables when he is ready to plot his position on the chart.

Example 2.—May 23, 1918, during p. m. twilight; sextant altitude of star Leonis (Regulus) is 66° 18.2′ bearing S. and W.; W. T. obs., $6^h\ 45^m\ 18^s$; C—W, $4^h\ 18^m\ 02^s$; C. C., $-3^m\ 45.5^s$; I. C., 0.0; height of eye, 39 feet; dead reckoning position, latitude 34° 38′ N., longitude 65° 12′ W.

SOLUTION IN DETAIL

	h m s		h m s
W. T. obs.	6 45 18		
C. W.	4 18 02		
C. C.	— 3 45.5		
		R. A. M. S.	4 01 09.2
G. M. T.	10 59 34.5	Corr.	1 48.3
R. A. M. S.	4 02 57.5	R. A. M. S.	4 02 57.5
G. S. T.	15 02 32.0		
R. A.	10 04 02.6		
G. H. A.	4 58 29.4		
G. H. A. arc	74° 37′ 21″	G. H. A. arc	74° 37′ 21″
Long. W.	65 12	*ta*	9 44
t_{DR}	9° 25′ 21″	Long. W.	64° 53′ 21″ } Plotting position.
		Lat. N.	34 37 00 }
a =	8°		
Obs. alt.	66 18.2′		
Corr.	6.6	Dec.	12° 21.9′ N.
C. alt.	66° 11.6′	b =	35 — a = 84.4°
h_c	66 03.4	C =	22° 38.1′ — β = 71.5

$h_o - h_c$ 8.2′ towards on line of bearing. $Z = 155.9°$ W.

With dead reckoning latitude 34° 30′ and t 9° 30′ on page 212 take out 34° 37′ latitude in h/d column and 9° 44′ hour angle in Z/t column the latitude and hour angle of plotting position, opposite them note $a = 84.4°$ and $b = 35°$; combine b with d and get C, $C = b - d = 22°$ 38.1′ and corresponding to this value of C find $\beta = 71.5°$ and $h_c = 66°$ 03.4′, page 213. The difference between this $h_c = 66°$ 03.4′ and the observed $h_o = 66°$ 11.6′ is 8.2′ which lay off toward the star on bearing $Z = a + \beta =$ N. 155.9° W., and draw line of position at right-angles to that bearing.

IDENTIFICATION OF UNKNOWN STARS

The problem of identification of an unknown star is almost the same as the determination of the line of position.

In the astronomical triangle PMZ if we have observed the altitude and azimuth of the unknown star M we have the angle Z and the two sides ZM and ZP. If we let fall a perpendicular from M on the side PZ we divide the astronomical triangle into two right spheric triangles and may solve for declination and hour

angle using the tables as in observations of known bodies for altitude and azimuth.

$$PZ = 90° - L.$$

$$PM_1,\ PM_2,\ PM_3,\ PM_4 = 90° - d.$$

$$Pm_1,\ Pm_2,\ Pm_3,\ Pm_4 = 90° - b.$$

$$ZM_1,\ ZM_2,\ ZM_3,\ ZM_4 = 90° - h.$$

$$ZPM_1,\ ZPM_2,\ ZPM_3,\ ZPM_4 = t.$$

$$PZM_1,\ PZM_2,\ PZM_3,\ PZM_4 = Z.$$

Then

$$\begin{aligned} b &= 90° - Pm_1 = 90° - (C - 90° \quad L) = 180° - (C + L) \\ &= 90 - Pm_2 = 90 - (90° - L - C) = C + L \\ &= 90 - Pm_3 = 90 - (90 - L + C) = L - C \\ &= 90 - Pm_4 = 90 - (90 - L + C) = L - C. \end{aligned}$$

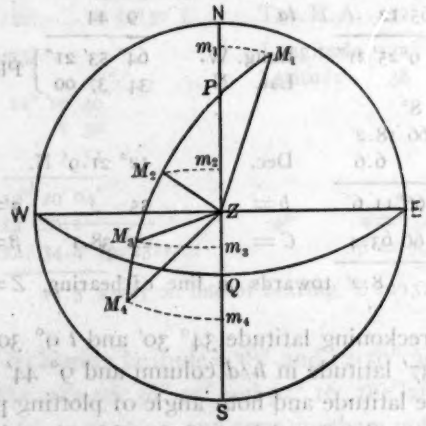


FIG. 2.

Whence we find b and thence t from the following rule:

$$b = C + L.$$

Where Z is greater than 90° mark C negative.

Where b is negative mark d, the declination, also negative.

Where b is greater than 90° use $180° - b$ and take the tabular value of t from 180° to find the hour angle.

These modifications will suggest themselves as the circumstances arise and need not be committed to memory.

The method of using the tables is as follows: Having taken the altitude and compass bearing of the star, observe the time, correct the altitude, compute the azimuth, measured from the elevated pole and either east or west, and the Greenwich sidereal time. and applying the longitude by dead reckoning obtain the approximate local sidereal time.

Enter table and find nearest values to h in the h/d column and Z in h/t column. If Z is greater than 90° use $180° - Z$.

Opposite the nearest values to h and Z, take out C in column marked C at top. Mark C negative if Z is greater than 90°. To this value of C add the latitude to get b. If this b is greater than 90°, take it from 180. Opposite b find d and t in columns marked h/d and Z/t at top. If b is negative mark d opposite name to the latitude. If b is greater than 90° take t greater than 90° also, that is, take $180° - t$ for t. To get the right ascension of the star reduce this t to time and take this hour angle in time from the local sidereal time. Then from the table of apparent places of stars for the upper transit at Greenwich in the Nautical Almanac, identify the star, and get its exact right ascension and declination.

Example 3.—November 5, 1918, in dead reckoning latitude 36° N., longitude 122° 15′ W., about 1 a. m., observed altitudes of two unknown stars as follows: At watch time $13^h\ 03^m\ 35^s$, Star No. 1, altitude 24° 51′ bearing N. 30° E. At watch time $13^h\ 05^m\ 35^s$, Star No. 2, altitude 13° 24′ 20″ bearing N. 142° E. C—W, $8^h\ 07^m\ 45^s$; C. C., + $1^m\ 30^s$; I. C., 0; Height of eye, 20 feet. Identify stars and plot lines of position.

SOLUTION IN DETAIL

Star No. 1

	h	m	s			
W. T.	13	03	35	Obs. alt. = 24°50′	Z = N 30° E.	
C.—W.	8	07	45	Corr. 6 28″		
C. C.	+	1	30	h_o = 24 43 32		
G. M. T.	21	12	50	On page 238 under a = 27°		
R.A.M.S.	14	51	40.8	C = 62° h = 24°44′	Z = 29°59′	
Red.		3	29.1	L = 36		
G. S. T.	12	07	59.9	b = 98		

$180° - b = 82$ $d = +61°56'$ $180° - t = 74°43'$ $t = 105\ 17 = 7\ 01\ 08$ E.

Long. 8 09

G. H. A.	1	07	52	G. H. A.	1	07 52
R. A.	11	00	57.9			

α Nos. Maj. (Dubke) R. A. 10°58′ 43.5″ Dec. + 62° 11.1′.

G. S. T.	12°07′	59.9″	
R. A.	10	58	43.5
G. H. A.	1	09	16.4

G. H. A. arc 17°19′ 06″

Page 271, a = 51°30′ b = 70° L_A = 35°48′ t = 74°47′ a = 24.9°

d = 62 11.1′ $180° - t$ = 105 13 Ely.

$180° - d$ = 117 48.9 Long.$_A$ = 122°32′ 06″

C = 47 48.9 h = 25°07′ M = 59°49′ β = −54.6

Corr. 24.4

h_c = 24°42.6′

h_o 24 43.5

0.9′ towards Z = 29.7°

Star No. 2

G. S. T. h m s 12 10 00.2 Obs. alt. = 13°24′ 20″ Z = 142° Ely.
Corr. 8 23 180° − Z = 38

h_o = 13°15′ 57″

On page 250 under a = 37°

C = − 73° h = 13°30′ Z = 38°14′
L = 36 h m s
b = − 37 d = − 28 44 t = 43°20′ E. = 2 53 20 E.
Long. = 8 08

h m s
G. H. A. = 5 15 40 G. H. A. = 5 15 40
R. A. = 6 54 20.2

E. Can Maj. (Adhara) d = − 28°51.5′ R. A. h m s 6 55 27.8

h m s
G. S. T. 12 10 00.2
R. A. 6 55 27.8
G. H. A. 5 14 32.4 G. H. A. arc = 78°38′ 06″
Page 247 under a = 34°, b = 45° L_A = 35°53′ t = 43 39 a = 61.1°
d = − 28 51.5′ Long. = 122 17 06
C = 73 51.5 h = 14°02′ β = 80.9
Corr. 42.2
h_c = 13 19.3
h_o = 13 15.9

3.9′ away Z = 142.

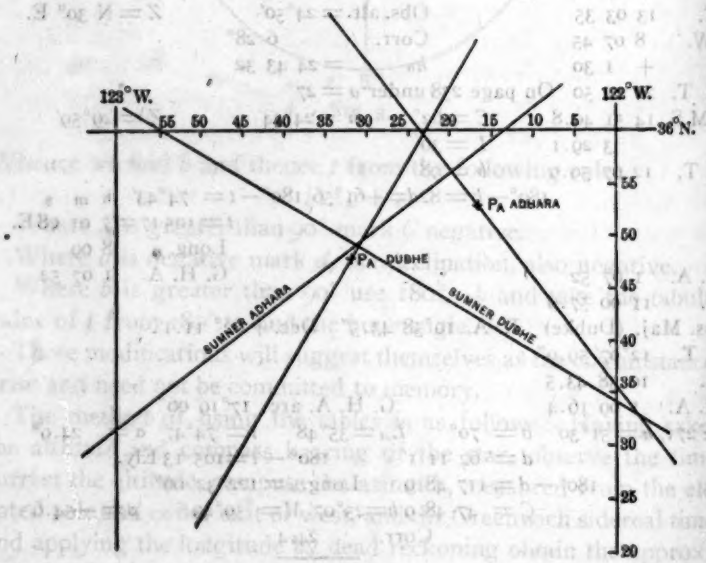
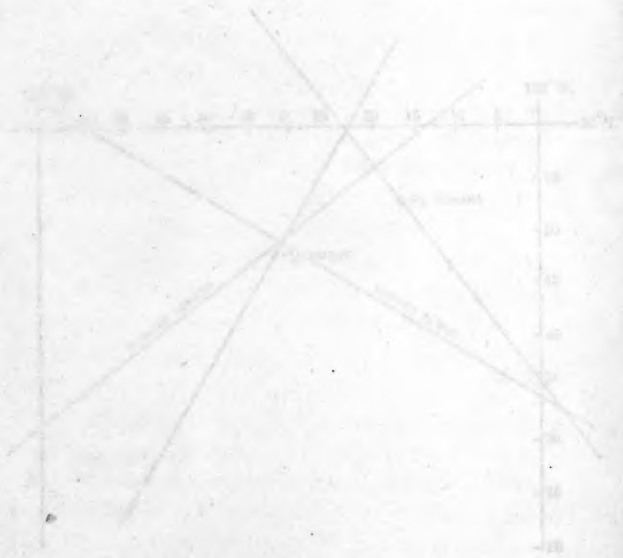


FIG. 3.

GREAT CIRCLE COURSE AND DISTANCE

To use the table to get great circle course and distance regard M of the triangle PZM as the point of departure and Z as the point to be arrived at, then entering the table with the latitude of the point of destination and the difference of longitude take out b opposite the nearest values of the angles, obtain C by subtracting the latitude of the point of departure from b and take out M the course and compute $90° - h$, the distance from h in the columns in which the difference of longitude and the latitude of destination were found. Since the actual latitudes and differences of longitude will not be found in the table, the values of the course and distance will be approximate, but the course will be close enough for all navigational purposes.

Commander de Aquino is preparing a new table with the perpendicular to every 15 minutes of arc, and omitting interpolation factors, and I understand others, in Europe, are preparing still more voluminous tables, but the present tables are within the limit of accuracy of observation in ordinary navigation.



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U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

DISPOSITION TO BE MADE OF NEUTRAL VESSELS AND THEIR CARGOES WHICH MAY IN TIME OF WAR BE SEIZED AND SENT IN TO AN ADVANCED BASE

By COMMANDER RAYMOND STONE, U. S. Navy

During the World War, while our country was yet neutral, the question indicated in the title subject was one of the many which came up for consideration and determination. By expression or implication it recognizes two factors; first, that regular judicial proceedings in prize probably cannot be had at an advanced base, and second, that the military situation may preclude sending such seized vessels into a port of the United States where a prize court may be in session.

Our participation in the struggle was portended to a practical certainty; and in anticipation thereof it seemed only wise and prudent to reach, as far as possible, some definite conclusions, and to outline a course of action for our naval commanders, in relation to this important matter.

It was the writer's privilege to prepare a discussion of the several phases, principally legal, of the subject involved; and although so far as he knows the regulations recommended were not actually applied in any given instance—largely, if not wholly, for lack of occasion—it is thought that the presentation to the service through the medium of these pages of the arguments employed and the conclusions reached may lead to valuable discussion of their soundness and practicability.

However earnestly we may wish and hope that international negotiations, conceived in optimism and prosecuted in mutual forbearance, may cause wars to cease, history justifies us in entertaining the possibility of future wars wherein we shall desire to

perform worthy deeds in conformity with honorable principles. For this it will be well to prepare in advance by formulating rules for guidance in cases likely to arise.

"Times change and we change with them." Views are modified as particular interests alter their aspect of importance or inconsequence. It may be that yesterday's solution of a problem will seem illogical or inappropriate to-day or to-morrow. It is with these ideas in mind that the following observations are presented for consideration.

OBSERVATIONS

The nature of this subject demands that it be discussed from two points of view; the one that of municipal law, the other that of international law. Where these two view points coincide there will be no conflict of conclusion; where they differ the differences must be reconciled in the light of reason and in consonance with current established practice of nations.

The municipal law governing United States naval forces in such cases is found in the Constitution itself as well as in the legislative acts of the Congress.

The Constitution of the United States, article I, section 8, clause 11, confers upon the Congress the power: "to . . . . make Rules concerning Captures on Land and Water." Congress has exercised this power in enacting the legislation contained in the Revised Statutes of the United States, Title LIV, Prize.

Of particular application to the subject under discussion is Section 4624, R. S., which reads as follows:

> Section 4624. Whenever any captured vessel, arms, munitions, or other material are taken for the use of the United States before it comes into the custody of the prize court, it must be surveyed, appraised, and inventoried, by persons as competent and impartial as can be obtained and the survey, appraisement, and inventory, shall be sent to the court in which proceedings are to be had; and if taken afterward, sufficient notice shall first be given to enable the court to have the property appraised for the protection of the rights of the claimants and captors. In all cases of property taken for or appropriated to the use of the government, the department for whose use it is taken or appropriated shall deposit the value thereof with the Assistant Treasurer of the United States nearest to the place of the session of the court subject to the order of the court in the case.

It will be noted that the language of this statute makes no distinction between *neutral* property and *enemy* property. From

this omission it may reasonably be inferred that the conversion or appropriation to use of captured property, that of neutrals as well as that of the enemy, is authorized; and the fact that this conversion or appropriation may be effected in advance of actual judicial hearing or condemnation is plainly stated: "*Before* it comes into the custody of the prize court, ..."

Historically interesting in connection with this same subject is the act of March 3, 1863 (37th Congress, session III, page 6, section 2) which, in part, is in these words:

Section 2. *And Be It Further Enacted*, That the Secretary of the Navy and the Secretary of War shall be, and they or either of them are hereby, authorized to take any captured vessel, any arms or munitions of war, or other material, for the use of the government; and when the same shall have been taken, before being sent in for adjudication, the department for whose use it was taken shall deposit the value of the same in the Treasury of the United States, subject to the order of the court in which prize proceedings shall be taken in the case; . . . .

Shortly after the passage of this act it was made the subject of a diplomatic protest by the British Ambassador to the United States. Because of this protest the Secretary of State under the date of May 9, 1863, requested an opinion of the Attorney General of the United States upon the provisions of the act involved, The opinion was requested in two questions, as follows:

1. Whether, under the clause of the Constitution which authorizes Congress to make rules concerning captures on land and water, that authority has been exceeded by the enactment of the second section referred to?

2. Whether the section itself gives such an extension to the belligerent right of capture and a corresponding diminution of the just rights of neutrals as is not warranted by public law?

In reply the Attorney General said:

I am clearly of opinion that the authority has not been exceeded, and that there is no conflict between the section of the Act and the clause of the Constitution indicated.

As to the second question, I do not perceive that the section itself gives any extension to the belligerent right of capture; and, therefore, there can be no corresponding diminution of the just rights of neutrals in that regard, for the section applies itself wholly to a state of facts existing *after* the capture. The principles and facts upon which the capture may be justified or condemned, are not touched by the section.

Farther along in the same opinion the Attorney General, in noting that municipal law may, and not infrequently does, conflict

with public international law, sometimes even with danger of grave complications, says:

> I am not aware of any settled doctrine of the law of nations, to the effect that a belligerent nation whose cruiser has captured a vessel, as prize of war, has the right, at its own pleasure and convenience, to appropriate the prize to its own use, *before condemnation*. (I speak not here of the case often mentioned in the books, in which the captor at sea is excused from sending in the prize for obvious reasons of necessity—that is an exception against the rule.) The rule is that the prize must be sent in for *adjudication*, not necessarily for the benefit of the captor nation, for it cannot be certainly known that the captor has any beneficial interest in the prize until that fact is ascertained by legal adjudication. (10 Op. Atty. Gen. 519.)

Moore (International Law Digest, 7, p. 620), quoting the *syllabus* of the opinion of the Attorney General, apparently misinterprets the real gist of the opinion, with which the syllabus is actually at variance. The syllabus states:

> . . . . This provision *is not in conflict with the public law of war*, and does not impair the just rights of neutrals. . . . ;

a statement which is broader than that contained in the body of the opinion, to wit,

> . . . . and, therefore, there can be no diminution of the just rights of neutrals *in that regard*,

that is, *capture*, but not appropriation or requisition before being brought into the jurisdiction of the prize court.

The Attorney General's attitude of mind regarding the justification under international law of the section in question is significantly indicated in the concluding paragraph of the opinion:

> Fortunately, the law objected to by the British minister is not imperative. It does not require the Secretaries of the Navy and of War, to take any prize, for the public use, before condemnation. It only authorizes them to do it, and leaves the act to their sound discretion. So that if there be any danger of dissatisfaction on the part of foreign powers, that danger may be easily avoided by abstaining from the use of the power granted by the said 2d section of the act.

The above quoted act of March 3, 1863, section 2, was expressly repealed by the act of June 30, 1864 (13 Stat., Section 35, p. 316) and is therefore no longer binding as municipal law. Section 27 of the repealing act, which is in effect a substitute for the section thus repealed, is identical with section 4624 of the Revised Statutes, previously quoted herein.

Section 2 of the Act of March 3, 1863, has fairly recently been substantially quoted in a judgment of the Judicial Committee of the Privy Council (British) hearing an appeal from an order of the Admiralty Division in Prize, in qualified support of their decision confirming the judgment of the lower court in respect to the right of the British Crown to requisition neutral cargo (Case of the *Zamora*, April 7, 1916). The appellate court referred to Section 2, not in full approval thereof—on the contrary they courteously regarded it as "somewhat unfortunate from the standpoint of an international lawyer"—but "as embodying the considered opinion of the United States authorities as to the right possessed by a belligerent to requisition vessels or goods seized as prize before adjudication." The higher British court seems to have been in ignorance of the fact that this act was repealed the year following its enactment, a half century ago.

The repealed statute is of interest as indicative of the view held by the United States authorities under the exigencies of the situation, the Civil War, existing at the time of its enactment.

So far, then, as municipal law is concerned Section 4624 of the Revised Statutes, which is still in force, apparently authorizes the appropriation or requisition of captured vessels and their cargoes *before* judicial proceedings and condemnation; and this, whether such vessels and cargoes are of *neutral* or *enemy* character, even *before coming into the custody of the court.*

It remains then to determine what authority, if any, there is under international law for such appropriation or requisition of captured vessels and cargoes in advance of judicial condemnation.

In investigating this phase of the question it will be well to consider the practice, expressly authorized or tacitly permitted with approval, on the part of the several maritime nations.

The German Prize Code of September 30, 1909, as in force July 1, 1915, prohibits requisition in the following language:

> 9. The commander may not, without the consent of the parties interested, requisition a vessel or goods not subject to capture or seizure, even if payment is made.

As to this, however, skeptical ones may suggest that Teutonic logic and shrewdness would not be overtaxed in arriving at a favorable "interpretation" of this prohibitory provision on occasion.

The French Prize Regulations of 1912, Article 148, permit requisition of enemy vessels.

The British view as presented in a recent famous case, that of the *Zamora*, April 7, 1916, above referred to, may be gathered from the recorded conclusion of the Judicial Committee of the Privy Council in that case:

> A belligerent power has by international law the right to requisition vessels or goods *in the custody of its prize courts*, pending a decision of the question whether they should be condemned or released, but such right is subject to certain limitations. First, the vessel or goods in question must be urgently required for use in connection with the defence of the realm, the prosecution of the war, or other matters involving national security. Secondly, there must be a real question to be tried, so that it would be improper to order an immediate release. And, thirdly, the right must be enforced *by application to the Prize Court*, which must determine judicially whether, under the particular circumstances of the case, the right is exercisable. (Italics are the writer's.)

It will be observed that neither the German Prize Code, nor the French Prize Regulations, nor the British view as set forth in the judicial decision just quoted, approves or sanctions the requisition of neutral vessels or cargoes prior to their delivery to the prize court for adjudication. Several cases tried before the French prize courts in the earlier stages of the current war seem to have awarded the neutral claimant full compensation where ships and cargoes had been taken and appropriated to the use of the French Government.

Article 49 of the United States War Code of 1900 which, although withdrawn from circulation in 1904, may yet be considered as expressing to some degree at least the views of the United States on the subjects treated of in that code, reads as follows:

> Article 49. The title to property seized as prize changes only by the decision rendered by the prize court. But if the vessel or its cargo is needed for immediate public use, it may be converted to such use, a careful inventory and appraisal being made by impartial persons and certified to by the Prize Court.

Note that in this article, which was doubtless so phrased as to come within the authorized provisions of Section 4624, Revised Statutes, *supra*, there is expressed no distinction between enemy and neutral property.

Article 6 of the same Code provides:

> Article 6. If military necessity should require it, neutral vessels found within the limits of belligerent authority may be seized and destroyed or

otherwise utilized for military purposes, but in such cases the owners of neutral vessels must be fully recompensed. The amount of the indemnity should, if practicable, be agreed on in advance with the owner or master of the vessel. Due regard must be had to treaty stipulations upon these matters.

Article 54 of the Declaration of London of 1909, which having been signed by the United States may for the purposes of this discussion be considered as expressive of policy and intention, touching upon the subject of the destruction of captured vessels, provides:

Article 54. The captor has the right to demand the handing over, or proceed himself to the destruction of, any goods liable to condemnation found on board a vessel not herself liable to condemnation, provided that the circumstances are such as to, under Article 49 (of this Declaration) justify the destruction of a vessel liable to condemnation. . . . .

From a consideration of the foregoing observations and references it appears that so far as municipal law is concerned there is sufficient authority to support United States naval commanders in the requisition or appropriation of neutral vessels and cargoes before their actual condemnation by a prize court; but that the consensus of opinion of the several great nations, including the principal belligerents in the present war, is against the practice of requisitioning or appropriating in advance of delivery to a prize court for judicial proceedings and decree. Professor George Grafton Wilson expresses his view thus:

While any prize may thus, under Act of June 30, 1864 (Revised Statutes, Section 4624), be legally converted to immediate public use, and would be under compelling circumstances, it is inadvisable to so convert neutral property, taken as prize, because indemnification will follow if the prize court fails to condemn the property.

Up to this point this discussion has had reference to the general question as to whether or not United States naval commanders have the right under either municipal or international law, or both, to requisition and appropriate, in advance of judicial condemnation, neutral vessels and cargoes, wherever seized and wherever sent in.

A special feature of the particular question under consideration is whether or not such rights as may be generally possessed can be exercised within the limits of an advanced base. For whatever cause seizures may be made the subsequent procedure in the normal course of events involves sending in to a port of the captor

the seized vessel in order that the case may be adjudicated before a civil court of adequate jurisdiction sitting as Court of Prize. In fact this procedure is required by the Prize Law of the United States (Revised Statutes, 4616). It is necessary because title to prize does not pass and invest anew until established and confirmed by judicial proceedings. Courts of prize are the sole competent judges of the validity of capture.

Prize courts are prohibited from sitting or performing their judicial functions in neutral territory (Hague XIII, Article 4).

It is highly improbable that duly established prize courts, as now constituted by statute, would be available at an advanced base; it is therefore almost certain that there would be no court at an advanced base competent, legally speaking, to pass upon the validity of capture. The question would then arise concerning the disposition to be made of a captured ship and her cargo. Obviously if there is no court of jurisdiction sitting at the advanced base no final judgment can be had. The captor is then confronted with a problem in solution of which are these alternatives: either he must send the captured vessel and cargo into a port of the United States, or he must make proper disposition of them in advance of prize court proceedings. What disposition can be made of them at an advanced base? It would seem to be beyond doubt that whatever right of disposition of captured property the captor may possess on the high seas, he may also exercise within the limits of an advanced base under his authority, provided that such advanced base is not situated within neutral territory.

This immediately brings into consideration the status of such advance bases as we now possess, or may hereafter obtain, in leased foreign territory. For example, Guantanamo, Cuba, and Fonseca, Nicaragua. Is the United States naval station at Guantanamo in foreign territory within the meaning of international law; that is, if the United States were at war and Cuba were neutral, would this naval station be in neutral territory?

The jurisdictional status of leased areas has been the subject of much discussion and consideration in the past. Volumes of correspondence of a diplomatic nature have passed between the great powers in relation to the international character of the areas leased by China to the several powers. The actual status of the

territory acquired by lease from China to the various European powers is a matter upon which there can be said to be almost unanimous accord. Whether or not sovereignty as well as administrative jurisdiction passes with the lease is still in question. In a report of Minister Conger to the Secretary of State, Mr. Hay (Foreign Relations, U. S., 1900, 386), he says:

> I have conferred with the English, German, Russian, French, Spanish, Netherlands, and Japanese ministers upon the subject, and all of them except the Japanese agree that the control over all of these leased ports has, during the existence of the lease, passed as absolutely away from the Chinese Government as if the territory had been sold outright, and that they are as thoroughly under the jurisdiction of the lessee governments as any portion of their home territory, and their consuls, accredited to China, would not attempt to exercise jurisdiction in any of said ports.

Territorial jurisdiction may be based on initial, or fundamental, sovereignty, on lease, or on some other special ground. The jurisdiction based on sovereignty is in general exclusive, though some exceptions are sanctioned by international law and practice. The jurisdiction based upon lease is naturally dependent upon the terms and conditions of the lease, which are various. In the Chinese lease of Wei-hai-wei to Great Britain, July 1, 1898, it is agreed that, ". . . . Within the above-mentioned territory leased Great Britain shall have sole jurisdiction. . . ." Article III of the convention leasing Kuang Chau Wan to France by China, ratified January 5, 1900, says: "The territory shall be governed and administered during the 99 years of the lease by France alone, so that all possible misunderstandings between the two countries may be obviated. . . ."

The agreement between the United States and Cuba of February 23, 1903, contains the following:

> Article III. While on the one hand the United States recognizes the continuance of the ultimate sovereignty of the republic of Cuba over the above described areas of land and water, on the other hand the republic of Cuba consents that during the period of the occupation by the United States of said areas under the terms of this agreement the United States shall exercise complete jurisdiction and control over and within said area with the right to acquire (under conditions to be hereafter agreed upon by the two governments) for the purposes of the United States any land or other property therein by purchase or by exercise of eminent domain with full compensation to the owners thereof.

On the face of it this article seems to indicate that while Cuba does not cede to the United States ultimate territorial sovereignty over the leased areas she nevertheless agrees that the United States shall, during the term of the lease exercise plenary and exclusive jurisdiction over such territory. Under this interpretation of the conditions of the agreement it would not seem to be claiming too much to maintain that for all purposes of both peace and war the United States naval station at Guantanamo and, by analogy, that at Fonseca, Nicaragua, are wholly within the jurisdiction of the United States.[1]

After reviewing the principles and practices discovered in the foregoing discussion it seems not unreasonable to conclude that although the practice of requisition and appropriation of neutral vessels and cargoes which are presumptively liable to condemnation, in advance of their delivery into the custody of a prize court, is authorized by the domestic law of the United States, the same is not recognized by international authority or agreement and for this reason should be indulged in under no condition other than that of imperative military necessity..

The following suggestions have been made as rules for guidance in the circumstances of the case under consideration:

1. A neutral merchant vessel which may be seized for probable cause, whether fault of ship or fault of cargo, should, in all cases where compelling necessity does not render such course impracticable, be sent in with as little delay as feasible to a port of the United States where a Prize Court is or may be sitting.

2. Should, however, military exigency forbid such sending in, the neutral merchant vessel so seized may be detained in company with the captor forces or sent in to an advanced base of the United States naval forces and there detained until the passing of such exigency.

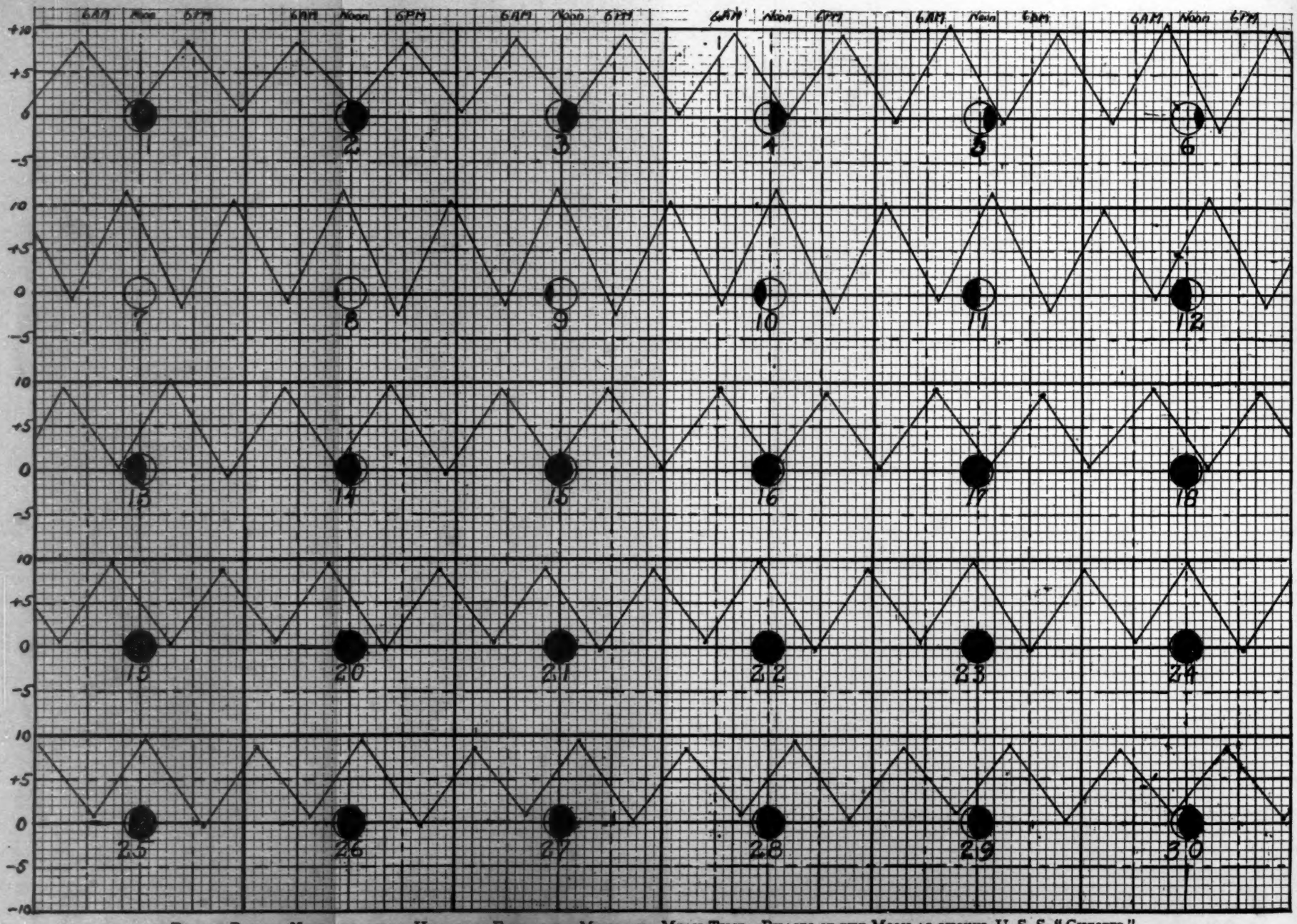
3. If the captor forces have need, for immediate public use, of the neutral merchant vessel or of her cargo so seized and sent in

[1] The analogy is perfect so far as Nicaragua is concerned, under the provisions of Article II of the Treaty, No. 624, between the United States and Nicaragua, proclaimed June 24, 1916. There is, however, a flaw in the title to the whole Gulf of Fonseca, because of the riparian rights of the neighboring states, Salvador and Honduras, with whom appropriate treaties have not yet been concluded.

to an advanced base, the vessel and cargo may be converted to such use, a careful inventory and appraisal of the property so converted being made by impartial persons and certified and transmitted to the Prize Court along with other related documents and evidence.

4. The conversion to captor's use of neutral vessels and cargoes, prior to delivery into the jurisdiction of a court of prize, is always inadvisable and should be resorted to only under compelling circumstances.

5. In all cases of requisition or appropriation to use of captured vessels or cargoes, whether enemy or neutral, in advance of Judicial proceedings and decree, the Navy Department should be promptly and fully informed in order that the provisions of Section 4624, Revised Statutes, concerning depositing in the treasury the value of the property so taken, may be complied with.



PORT OF BOSTON, NOVEMBER, 1919. HEIGHT IN FEET. 75TH MERIDIAN, MEAN TIME. PHASES OF THE MOON AS SHOWN, U. S. S. "CHESTER."

U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

TIDE DIAGRAM

By Lieutenant Albert E. Schrader, U. S. Navy

Some time ago while the writer was serving aboard the *Dorsey*, in Adriatic waters, he had the opportunity of using a tide graph similar to the one attached.

The Italian Hydrographic Office prints these graphs monthly for their principal ports.

In ordinary navigation it matters less to the captain or navigator to know that high water will occur at *exactly* 9.53 a. m. to a height of *exactly* 6.2 feet than to know that it occurs *shortly before* 10 a. m., and that the height is *about* 6 feet.

There are times, of course, when the exact data are absolutely necessary, such as when a gunboat has to go across some Mexican harbor bar with little or no water to spare. However, such cases are out of the general run.

The graph will prove its value to vessels which frequently make the same port.

After a long weary vigil making port in fog or bad weather, the navigator is just as likely to pick September as November out of the tables, or the 13th as the 18th, and so on, by the dozen. Right there is where the graph "comes in strong." No thumbing through pages with numbed fingers, no wild efforts to find the intersection of the proper arguments, no reading fine print—simply look at the diagram, *it shows at a glance*.

The necessary data were taken from the "General Tide Tables, 1919." Any assistant navigator with the aid of a sharp pencil and a ruler can plot a month's curve on cross-section paper in 15 or 20 minutes.

No originality is claimed for the idea, but it is considered of sufficient value to "pass down the line."

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THE INFLUENCE OF SEA POWER ON CIVILIZATION

By SIDNEY GUNN, Curator, U. S. Naval Academy

The influence of sea power on history has been discussed by Admiral Mahan and many other writers, so that its decisive effect on numerous occasions has been pointed out, but the debt that civilization owes to seamen has not yet been fully recognized. One reason for this is the fact that outstanding, spectacular instances of the application of sea power receive most attention from historians. It is pointed out how free institutions were saved by such sea battles as those of Salamis and Lepanto, but rarely is it made clear how nautical enterprise and nautical skill, in the same silent, steady, and often imperceptible, manner that has been characteristic of Allied naval activity in the present war, have contributed to build up the very free institutions which they have so gloriously saved on these occasions.

Professional navies are regarded as modern developments. The merchant marine is looked upon as their predecessor, and the sailor for gain is supposed to be a far older figure than the sailor for glory. This is, however, not true, for the qualities of which the naval officer is supposed to be the embodiment have always been necessary to the progressive seamen of the world. Ships built exclusively for military purposes and manned by professional military officers may be comparatively modern, but, on the other hand, it is only within very recent times that any considerable voyage could be undertaken without the probability of fighting being necessary, and the farther back into history we go, the greater does the likelihood of seamen having to fight become. Up to the eighteenth century international law, even in times of peace, was practically non-existent, and ships of one nation were constantly attacked by those of another country; so that all went armed, and what might be considered a state of perpetual mari-

time warfare existed. Piracy, too, was not put down till the beginning of the nineteenth century, so voyages often involved the necessity of fighting to avoid walking the plank. In fact, it may be said that only during the nineteenth and that part of the twentieth century which preceded the present war did a merchant marine of non-fighting seamen exist. Fighting has thus been the seaman's function quite as much as trading has, and the discipline and co-operation cultivated by military organization have been characteristic of sea life even before the development of professional navies.

The element of danger in sea going has thus always been considerable, so that only the most venturesome men were attracted to it, and only the most rugged were able to survive its perils and hardships. This has undoubtedly made seamen as a class more likely to be formidable fighters than men enured only to the far less constant dangers of shore existence, and so communities of sailors have usually been able to maintain their independence against anything like equal numbers, while in some cases, by the aid of the protection afforded by the sea surrounding their homes, they have offered a secure retreat for freedom when all the rest of the world was the victim of tyranny.

A striking instance of this kind took place in the island of Crete before the dawn of history. Up to the opening of the European war this island was one of the most important regions for archæological investigations as to the early history of European society. Extensive remains of a high degree of civilization that flourished up to 1500 B. C., were unearthed. Vast structures were found, and the engineering skill displayed in them would have done credit to the present generation, while everywhere these prehistoric Cretans left traces of extraordinary knowledge and remarkable power.

Now all this civilization was the result of the sea power of the inhabitants of the islands. They were immune from attacks by foes without a navy capable of making the then considerable voyage from the mainland to their island home. They enjoyed the splendid isolation which Americans used to think was the perpetual heritage of the United States, and behind their wall of brine they were able to live in that security which is essential to the development of civilization. For centuries this security was theirs, and during those centuries civilization was advanced

enormously by them. We don't know the exact contributions they made, but it is evident that they did much to improve both the practical arts and the science of government. We only know of them through the fables invented about them by the Greeks, but these fables are figurative history. Dædalos, in the Greek fables, built the Labyrinth and also devised wings with which to fly; and other stories dealt with Minos and Rhadamanthus, two brothers who ruled over Crete and were such extraordinarily just law givers that when they died they were made judges over the dead. The Dædalos story is merely a rather emphatic way of saying that the Cretans made wonderful advances in engineering and mechanics, while that of Minos and Rhadamanthus points to an equally striking development in legal procedure, so that the growth of the great material civilization of which we are so proud to-day, and the development of our legal system, both owe not a little to the protection afforded them in their early stages by Cretan sea power.

After the Cretans the next great nautical race was the Phœnicians. They traded all over the world, and while they don't, perhaps, look very natural in the rôle of apostles of justice and liberty—they were very much given to piracy and slave dealing—they nevertheless did much to advance material civilization. They spread the latest discoveries over the world. When, for instance, some progressive tribe, or one fortunately situated near supplies of easily workable ore, learned the secret of making bronze or of working iron, the Phœnicians carried the news over the sea to the rest of the accessible world. They are also said to have invented glass making, and while the story of some of their sailors discovering the process by finding glass under a camp fire they had made on a beach in which soda existed in the sand may not be true, they certainly did spread the knowledge of the way to produce the substance, as they certainly did much else to advance civilization by the intercommunication their constant voyaging maintained.

Carthage was nothing but a continuation of the Phœnician power, which had its center in Tyre, and if Carthage does not exemplify sea power in a positive way, it certainly does so negatively. Carthage became great and aimed at subduing the world and establishing her tyranny over it, but Admiral Mahan has shown that this was prevented as much by Roman sea power as

by anything else, so here civilization was protected from a serious set back by sea power.

One of the most striking cases of the beneficent influence of the sea on civilization is that of Venice. Early in the fifth century, about 420 A. D., to be exact, the Roman empire, and with it all that was most advanced in the way of material civilization, was almost extinguished by the inroads of Goths, Vandals, and other German barbarians of the north. These early exponents of Kultur carried disorganization and destruction everywhere that western civilization existed, and law and order were threatened with extinction. Then it was that certain exiles from Italian cities betook themselves to a group of islands in the Adriatic where the barbarians could not follow them. Here they lived in poverty but unmolested by the invader, for the sinuous passages between the islands were defended from the water against a foe who had few boats and no skill in their use. Here the old institutions were kept alive, and here hardship and poverty awoke again the old Roman ideal of liberty. Living in the very sea itself it was not strange that the Venetians became sailors, and the sea power they developed made them the most powerful and progressive state in Europe for centuries. They built up a commerce, and the wealth it brought enabled them to make their city, in spite of its situation in a morass, the most beautiful as well as the strongest in Europe. Not only this, but they developed economic organization that has done an incalculable amount to make the complex and elaborate relations of modern life possible. Their influence in creating the intricate system of banking and commercial credit we now enjoy was considerable, and there has been no greater civilizer than the delicate machinery that makes extensive commercial intercourse possible. They also acted as intermediary between the Orient and Western Europe. They took part in the crusades, and carried on a continuous commercial crusade both before and after the great military movements against the Saracen, in this way doing much to enrich and refine the life of Europe by introducing the arts and the products of the Levant. This was the work of their trading seamen, but their fighting sailors were no less active. They took part in many expeditions that secured and extended western civilization, and at such times as the battle of Lepanto they were an important, if not a decisive, factor in

bringing about the fall of Turkish power at sea. Early in her history Venice devised a symbolical ceremony by which she was annually wedded to the sea as a recognition that her greatness was derived from that source. A ring was cast into the waters of the Adriatic, and in this picturesque way acknowledgment was made of the maritime basis of Venetian power, and as this power was used both to safeguard and advance western civilization for centuries, it follows that that civilization, with its democratic aspirations and great material triumphs, is to a large extent the creature of sea power.

Constantinople did a great deal to preserve the learning of the ancient world, and much of its ability to do this was due to sea power. For a long time the independence of this great city was only maintained by her sailors. At one time it was only possible as a result of the superiority they possessed through knowing the secret of making the so called "Greek fire," an inflammable material that water did not extinguish (perhaps because of its containing quick lime) and therefore was a weapon the exclusive possession of which made their fleets able to withstand the vastly superior forces of the Mohammedans. This invention was the result of sea experience, and its was adapted primarily to use at sea; so that its benefits must be considered as the contribution of sea power to civilization.

Genoa is another maritime community that has contributed greatly to the advance of western civilization. Genoa, like Venice, was active in maintaining relations with the Orient, and shares with Venice the credit for developing much of our commercial system, even though the two cities often engaged in bitter wars with each other. Our main debt to Genoa, however, is for the discovery of America. Christopher Columbus was a Genoese, and even though Spain provided him with ships to make his voyage to the New World, he got, what is far more important, his seamanship, his initiative, and his ambition, from the training he received and the traditions he imbibed in the active and efficient ships of his native city. The discovery of America has had more influence on the development of democracy and on the advance of material civilization than any other event in the world's history, and for it we are plainly indebted to the conditions and qualities developed by sea faring.

Portugal has also contributed much to human progress as a result of her marine activity. A nation with a large sea faring population, she has afforded a peculiar contrast to her immediate neighbor, Spain. Measured by Spanish social and political standards, Portugal has always been extremely liberal and progressive, and, apart from the discovery of America, the credit for which Genoa shares with Spain, her foreign influence has been vastly greater when we consider the disparity in size between the two countries. Portugal first gave the world a knowledge of the water routes to Africa and the Orient. Vasco da Gama's voyage by which he opened up the vast eastern world to Europe, and Magellan's voyage around the world, were only second to Columbus's explorations in their effect on history, and they were plainly the result of the skill and enterprise developed by Portugal's extensive sea activities nearer home in the centuries preceding them.[1]

The sea power of Holland enabled that country to resist the tyranny of Spain, and it also enabled the Dutch to assist greatly in the commercial development of the modern world. The economic center of civilization to-day, New York City, owes its origin to Dutch maritime enterprise, and South Africa, which has lately become increasingly prominent in the economic and political world, must also be credited to the same thing as far as its foundation is concerned. What the Dutch have done to develop the East and the West Indies and establish the commercial relations that bind us to those regions is also considerable, so that, even though their achievements have been mostly economic, they have been vastly significant; for economic influences are fundamental at all times, and preeminently important in the civilization of to-day. Modern life would be very much less comfortable and less refined if it were without the contributions made to it by Dutch sea power, and modern government would undoubtedly be less enlightened and liberal if it were not for the principles of justice which the Hollanders have been able to establish as a result of their nautical skill.

The effect of English sea power has been much discussed, but its negative rather than its positive side has lately received most

[1] Magellan led a Spanish expedition, but he was a Portuguese, as were his chief associates and many of his crew.

attention. The English conception of freedom has not only been developed and protected, but has spread throughout the world largely by the agency of the sea. Every civilized country now has a government made on the English model, and there is no doubt that this wide diffusion of Anglo-Saxon political methods is the result of the ubiquitness of British colonies and of British and American commerce. England's sea power developed what the seamanship of Genoa discovered, North America, and what would the modern world be politically and economically if that region had not been developed or had been developed under despotic instead of liberal auspices? English sea power also suppressed piracy and the slave trade on the high seas, and it has on many occasions suppressed violence and offered an asylum to the persecuted in the remoter or less orderly regions of the world, thus establishing the navy as conspicuously and peculiarly the guardian of law, order, and justice.

The above instances are only some of the more obvious cases of the influence of sea power upon civilization that would appear at a cursory glance through history. Many others could be cited, while the indirect effects of maritime power are numberless, and are frequently so imperceptible as to pass unnoticed. It is plain though that the sea has been one of the greatest influences in making our modern civilization what it is, and that what is essentially naval power has been just as active in times of peace in building up our resources and our institutions as it has been in times of war in protecting them.

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MANILA BAY IN 1898

By CAPTAIN EDWARD L. BEACH, U. S. Navy

Recently I have read journals and letters I wrote in 1898 while attached to the U. S. S. *Baltimore* in Manila Bay. The events of those stirring days come vividly to mind and are fresh in memory as if they had happened yesterday. What follows is a narrative of those events as they seemed at the time to a participant, so this article is not history. No attempt is made to give a connected account or description of Admiral Dewey's campaign. A person in a battle, particularly if he plays a subordinate part, sees but a small part of the actual battle, and his mental vision generally is limited. All that is offered in this paper are the views and ideas of a subordinate officer whose own part was not large, and these views are given as they existed at the time, uninfluenced and unmodified by knowledge gained later. Here goes!

Late in April, 1898, the U. S. S. *Baltimore,* in company with other ships of Commodore Dewey's squadron, left Mirs Bay, China, bound for Manila.

The captain of the *Baltimore* was Nehemiah Mayo Dyer, who was then 60 years old. Captain Dyer had entered the navy during the Civil War as a volunteer officer. Previous to this he had seen rough service in whaling ships. I think that by nature he had a vehement temper, and that this had been accentuated by his early training in merchant ships where the crews frequently were rough and disorderly and understood better the meaning of hard knocks than of soft words. Aboard the *Baltimore* Captain Dyer sometimes seemed unnecessarily harsh. His standards of character and duty were high. And when, as happened at times, he believed officers and crew did not measure up to his standards, his reproofs and reprimands were expressed in violent language. His uncompromising intolerance, his harsh temper, caused us to fear him at all times, and sometimes to carry with us a sense of

injury. But in time we came to know he was magnificent in his efforts to keep his ship and his officers and crew high in efficiency and high in morale. Though not gentle in methods he was withal an officer and a gentleman of the highest, truest type; and in remembrance of his sterling character the Navy Department has recently named a new destroyer *Dyer*.

When we steamed away from Mirs Bay, that April day, we knew but little of the Philippine Islands, not even that Manila was spelled with but one "l." Rumor, eagerly believed, told us that the narrow entrances leading from the outside to Manila Bay were filled with mines and defended by high-powered modern coast defense cannon, all of which added to the intense interest that was with us.

On the second day out "all hands" were called aft to the quarterdeck. Here Captain Dyer made a speech to his ship's company.

"Men of the *Baltimore*," he began, "I will read to you a proclamation recently made by the Spanish Governor General at Manila. It is as follows:

Spaniards, the North American people, constituted of all the social excrescences, have exhausted our patience and provoked war with their perfidious machinations, with their acts of treachery, with their outrages against the law of nations and international conventions.

The struggle will be short and decisive. The God of victories will give us one as brilliant as the justice of our cause demands. Spain will emerge triumphantly from this new test, humiliating and blasting the adventurers from those states that, without cohesion and without a history, offer to humanity only infamous traditions and the ungrateful spectacle of chambers in which appear united insolence and defamation, cowardice and cynicism.

A squadron manned by foreigners, possessing neither instruction nor discipline, is preparing to come to this archipelago with the ruffianly intention of robbing us of all that means life, honor, and liberty. Pretending to be inspired by a courage of which they are incapable, the North American seamen undertake as an enterprise capable of realization the substitution of Protestantism for the Catholic religion you possess, to treat you as tribes refractory to civilization, to take possession of your riches, and to kidnap those persons whom they consider useful to man their ships or to be exploited in agricultural or industrial labor.

Vain designs! Ridiculous boastings!

Your indomitable bravery will frustrate these attempts. You will not allow the faith you profess to be made a mock of impious hands. The aggressors shall not profane the tombs of your fathers, they shall not gratify their lustful passions at the cost of your wives' and daughters' honor, nor appropriate the property that your industry has accumulated.

No! They shall not perpetrate any of the crimes inspired by their wickedness and covetousness, because your valor and patriotism will suffice to punish them and abase them.

There was more to this proclamation. Captain Dyer's clear, penetrating voice, rang out with increasing indignation. He also read, though not as part of this proclamation, a Spanish statement which said that "the American President, McKinley, is a naturalized Chinaman from Canton."

I laugh now as I recall the picture of Captain Dyer stamping on that paper as if it were a Spaniard, but the effect then was to carry officers and crew headlong with him. We were all as mad as he was.

We now began to make preparation for the battle that we knew awaited us. After the *Baltimore* had been built particular attention had been called by writers on naval subjects to the fact that in sea battles much damage was always caused by wooden splinters flying about, killing and wounding men, and spreading fires. So one of our drills had been, when the order "Clear ship for action" was given, to tie tags marked "overboard" to all sorts of wooden articles, such as chairs, desks, ladders, tables, etc. So now we were engaged in "clearing ship" in earnest, stripping her, getting her ready for battle, and throwing overboard hundreds of different articles. I'll always remember the grief displayed by our chaplain when he saw his pulpit heaved overboard.

At about 1 o'clock Sunday morning, May the first, we slowly steamed into the South Channel entrance to Manila Bay. The night was dark. The sky overcast with clouds. The ships were all completely darkened. We were now but 25 miles from Manila. Everybody except those on duty below was on deck. No one wished to sleep. We all knew that soon we would be in battle and a tense expectancy possessed us. So we gathered in groups about the deck and talked in low tones. Ahead of us could be seen the dim shape of Commodore Dewey's flagship, the *Olympia*. Astern of the *Baltimore* were the other four ships of squadron. I was in the starboard waist, amidships, looking towards the shadowy shore, less than a mile distant. Suddenly, in the direction I was looking, there was a vivid streak of fire, the reverberating roar of a great gun, and a violent rush of wind. I was wild with delight. Always had I hoped that some time I might have the sensation of being "under fire." I had longed to know

just how I would feel. Would I be scared or excited? Or would I be "cool, calm, and collected"? Such had been boyish thoughts, and finally this desired experience had come. Again and again the fort fired at us, at me, I felt in my heart, the shots all missing me by but a narrow margin, passing directly over my head. First I estimated the shots had cleared me by 50 feet. But the more I thought of the distance, the closer I felt each shot had come. So I reduced my first estimate to 40 feet, then to 20, and finally, with further thought, came down to two. I thought of taking off these two feet, but realized that this would have taken off my head, so I felt that two feet was about right. And I had been no more scared than when throwing the chaplain's pulpit overboard.

While engaged in these delightful, exultant estimates, some officer ran up from forward. "Say Beach," he exclaimed, "I was on the forecastle, each one of those shots passed right over my head, the last one was so close the wind of it blew my cap off."

I was just about to make an indignant rejoinder when an officer came up from aft. "You don't know what you're talking about," he shouted. "I was on the poop deck, not one of those shots passed 10 feet away from me." I later quarrelled with officers from the five other ships, each of them foolishly maintaining that each shot had passed close to him. So this question was never settled.

We were now headed for Cavite, which is seven miles by water from Manila, 20 miles by land. Here the Spanish Navy Yard was located, and here the Spanish warships were awaiting us.

The *Baltimore* began to shoot at 20 minutes before 6 that Sunday morning, May 1, 1898. I shall describe only that part of the battle, of which, when it was over, I had intimate, personal knowledge. So I shall not, in learned fashion, describe the tactics employed, because I was in the *Baltimore's* engine room and didn't see any tactics nor did I know anything about them. Nor will I tell about the relative power of the opposing forces, nor of hits per gun per minute, nor of the thousands of incidents that give life and vividness to a battle and which bring victory or defeat. All that I saw of the battle of Manila Bay was the inside of the *Baltimore's* engine room, with its hot steam pipes, and valves, and cylinders, and pumps. The oilers and machinists, dripping with perspiration, rushing about. And I saw something

else—Irwin's shoes; and kept on seeing them throughout the fight.

I was at my station in the after engine room, operating the reversing and starting levers and throttle valves of the starboard engine. Assistant Engineer Brice had the same duty for the port engine; Assistant Engineer Cone was in the forward fire-room. Chief Engineer Ford was with me. Captain Dyer was on the bridge. My station was directly under the engine-room hatch. Looking up, through the hatch gratings, I could see the bottoms of the soles of Ensign Irwin's shoes. Vertically upward from these shoes for a distance of six feet and three inches, extended one hundred and ninety pounds of vibrant Americanism, known as Irwin. He had taken a place which gave him a clear view of the enemy's ships, and where he could advantageously direct the fire of his four 6-inch guns.

This engine-room hatch was a veritable sounding box. The roars from our own guns came reverberating down this hatch, tremendously magnified. Near to one of the *Baltimore's* 8-inch or 6-inch guns the sound of the report was muffled compared with the crashing, smashing, banging reverberations that came blasting down the engine-room hatch. Although our ships were all firing, and were all close to the *Baltimore,* I never heard a shot from any of them. At the end of the battle my impressions were a dripping, sweating engine room, a series of hundreds of deafening, ear-bursting explosions, and Irwin's shoes.

In battle it is only the leaders who have occasion to see things in a big sense. The rest of us are there to obey orders, to shoot and hit what we shoot at, to steer the ship, to work the engines as directed. We are not attending a show as spectators; the vision of each of us is small. And at a battle's conclusion a man's mind is too intent on what he is doing to take mental note of matters outside of his own duties. Later, for months, the battle is the chief topic of conversation, it is in the atmosphere he breathes, he absorbs all sorts of information and acquires intimate knowledge of the battle, obtains a clear mental picture of all details. I remember that after the battle of Manila Bay I wanted to write home all I saw of the fight, and of how little I had at first to write about. I believe that in the Battle of Manila Bay I made a record never equalled in the history of warfare, that of looking steadily,

hour after hour, through the ear-blasting roar of great guns, at the bottom of a man's shoes. I was constantly interrupted by signals from the bridge, to increase or decrease speed of the starboard engine, to reverse it, and stop it, and occasionally gave orders to machinists and oilers. But when not so employed, was constantly looking upward and shoeward.

At my station were the speaking tubes connecting with the bridge and with different places, amongst them the fire-rooms. Price and I were the only means of communication between the firerooms, which for protection against bursting shell were caged down by heavy armored gratings, and the rest of the world.

Some minutes after the shooting began I was called up by the forward fireroom.

"What is it?" I shouted through the speaking tube.

"Hello, Beach. This is Cone, speaking. Send me some news to cheer up my men."

"No one has sent me any news, Cone, but I'll bet that Irwin's shoes ——."

"I'm not interested in Irwin's shoes nor in excuses. Send me news of the fight right away."

Down the hatch crashed the language of 8-inch guns, stopping conversation for the moment. Then I called up the forward fireroom.

"Hello!" I shouted, "report to Mr. Cone that the *Olympia* has just sunk the Spanish flagship."

I kept my ear to the tube. "Hooray," was all the answer given me. But I heard my message repeated. Then a wild cheer. Then a furnace door slammed shut, and an Irish voice sang out: "Take that, ye damn durrty dago."

A few minutes later I was again called up.

"Hello, Beach, send me some news of the fight!"

"Say, Cone, Irwin's shoes ——."

"Drop that. What other Spanish ships have we sunk."

I had received no news of any description, not one word. They were too busy on deck with the guns to bother about news bulletins. And in fact, at the time, the effect of our shots on the Spanish ships was not known. But explanations would not have been interesting in the fireroom. So I shouted: "The *Baltimore*

has just sunk a Spanish cruiser." Loud hurrahs came back to me through the speaking tube when Cone repeated this.

Five minutes later I was again called by Cone.

"The temperature here is 170°," he said. "Send more news, lots of news, omit all reference to Irwin's shoes."

And then I started in in earnest. Every few minutes I sent a bulletin to the forward fireroom. My ferocity was ungovernable. I sank Spanish battleships, cruisers, gunboats, and torpedo-boats, without count. For four hours, at from five-to ten-minute intervals, I destroyed Spanish warships. Commodore Dewey that day sank 11 ships. My record was afterward counted up to be 96.

It was boiling hot in the fireroom. We were running slowly, so there was but little to do, and as all three watches were at their stations the firerooms were crowded with men. My bulletins served to keep them interested and contented. I may have, in the excitement of the moment, not sent in accurate bulletins. But it is quite certain that 100 per cent of the Spanish ships that fought us were sunk.

At different times I would ask the chief engineer, Mr. Ford, a fine old veteran of the Civil War, questions. He had been with Farragut in the latter's battles, and therefore was an authority.

"Chief," I asked, "is this a real battle?"

Mr. Ford smiled. "Yes," he replied, "this is a real fight, and a big one, too." And to accentuate his remark, deafening answers came down the hatch.

"Chief," I later asked, "do you think that Irwin's shoes — —."

But my question was lost in a wild, overwhelming uproar. I knew we had been hit. Right over my head was a terrific crash. The effect was so shattering that I momentarily thought a tremendous shell had burst in the hatch. It afterwards developed that a 4.7 solid shot from the *Isla de Cuba* had pierced the *Baltimore's* starboard bulkhead, the sides of the engine-room hatch, passing 18 inches below Irwin's shoes; it struck the curved inside of the shield of a port 6-inch gun, carromed as a billiard ball, and at the end of its mad flight lay spinning in the starboard waterway. It had entirely encircled one of Irwin's gun crews but had hit none of them.

The *Baltimore* was struck in all seven times and had eight men slightly wounded. Most of the other ships were struck, but none received injuries that were serious. I did not hear of any incidents that happened aboard any of the other ships, except the *Raleigh*. Here, as I was told later, the "powder division officer," who had charge of supplying all of the guns with ammunition, and whose men were servants, bandsmen, coal passers, and others, had not nearly enough work to do to keep his men busy. It does not take many men to hoist up 5-inch shell and powder charges. So, after using every man he could, he formed the leftovers, colored servants and other colored men, into a dancing party below decks. And while bombs were bursting in air, and the *Raleigh's* guns were vomiting destruction into Spanish ships, deep down in the *Raleigh*, as fiddles were scraping, it was:

"Balance yo' pahdnahs,
Dos y dos,
Chassy toe yo' right,
Gran' right 'n left."

This ends my description of the Battle of Manila Bay. I fear it will never be referred to as an historical document. In vain will one look in it for statistics and ponderous facts, for the number of misses per gun per minute, for the strategy and tactics, and for that awful thing, logistics. At the end of the fight all I knew was that we had met the Spaniards and had destroyed them. For further technical information the reader is referred to official reports. For further information concerning Irwin's shoes, apply to the captain of the super-dreadnaught *Oklahoma*.

The next day the *Baltimore* proceeded to Mariveles, a town near to the entrance of Manila Bay, where a Spanish fort was located. Captain Dyer demanded the surrender of this fort. The Spanish colonel, whose name was Caramba, or Miranda, was most anxious to surrender, but in worried tones he informed Captain Dyer that the *Baltimore* had anchored in the midst of a mine field and was in imminent danger of being blown into the Spanish equivalent of smithereens; he could not be responsible for the safety of the *Baltimore*, nor, should she be torpedoed, could he bear the idea of being accused of treachery by the Americans after he had surrendered. Would Captain Dyer please withdraw to a place, not far away, which he would guarantee was free from mines?

And, because thousands of hostile natives were gathering around the fort, animated by the purpose of wreaking vengeance against the hated Spanish soldiers, would Captain Dyer please, for protection, allow his wife and daughter, Señora and Señorita Cáramba, to come aboard the *Baltimore?*

Captain Dyer would. So the *Baltimore* moved to a place of safety, and Señora Cáramba and her daughter then came on board and were given the admiral's cabin to live in.

That night Ellicott had the middle watch as officer of the deck. It was a pleasant, peaceful night; the stars were bright, the breezes balmy; but there was a Spanish fort on shore, not far away. True, the colonel commanding had agreed to surrender, but we had not taken possession; and in it were stores of mines and torpedoes. It was conceivable that some fanatic might try to attach a torpedo or mine to the *Baltimore* and destroy the hated American ship, or gain access to a magazine and there start a fire. Less than three months previously the *Maine* had been destroyed. Or, under cover of darkness, some desperate Spanish soldiers might man some boats and pull to the *Baltimore* and attempt to steal aboard, overwhelm the watch on deck, and get possession of the ship.

Ellicott had all of these things in mind, careful officer that he was. He did not propose that any surprise of any nature should be worked off on him that night. So he had armed picket boats constantly steam around the ship, and sentries posted in many places about the decks, all keeping a wary lookout. The exciting and stirring event that occurred that night in no way caught Ellicott off his guard—he was prepared for it.

At 1 o'clock everything seemed peaceful. Far forward on the forecastle, the marine sentry, at the stroke of the bell, called out, in slow, singing tones, "Post number one, and all's well!" Each sentry, in his turn, passed the hail. It was reassuring. The sentries were wide awake, and on their jobs. Yet Ellicott was not lulled into security. Suddenly he thought he detected a faint but pungent odor of something burning. Ellicott sniffed slowly, carefully. "That is certainly something burning," he remarked, "and of a most strange and peculiar flavor." So quietly he called the quartermaster. The latter sniffed, and smiled in superior disbelief. Then suddenly exclaimed: "Mr. Ellicott! You're right! I smell something burning, a most remarkable smell, I never smelled nothin' like that, sorr, in all me life!"

"Keep quiet," ordered Ellicott, who was not to be rattled in spite of the hundreds of tons of ammunition in the magazine directly beneath him.

So Ellicott, accompanied by the quartermaster, went to different sentries near by; soon they all smelt this pungent, delicate burning odor; but it was difficult to locate where it came from. Then Ellicott quietly made a careful inspection. The odor grew stronger and stronger. Ellicott awakened Gunner Connelly; the magazines were opened—there was no smell in any of them. Gradually officers and men were awakened and got up; some were worried and begged Ellicott to sound the general alarm, which would have turned everybody out and sent him to his station. "Not yet," said Ellicott, tersely. He was not to be stampeded and had the situation in hand.

The strength of this burning odor constantly augmented. Finally Ellicott located it in the stairway leading below to the admiral's cabin. It was unmistakably here. I'll never forget the excitement that existed amongst us as we saw Ellicott disappear down that black hole, nor the calm way in which he said, as he was descending, "Do not sound the general alarm unless something happens below that should make it necessary." Many of us never expected to see him again, and all of us believed the ship would be blown up within a minute. An intense excitement existed; but not a word was spoken. Complete silence reigned.

Ellicott followed the smell to the door of the room where Señora Cáramba and her daughter were sleeping. He knocked on the door, steadily but gently, and in kindly, rather soft tones, said: "Open the door, please."

"Quien es? Oh, Santa Maria! Quien es? Que quiere?"

"Only Lieutenant Ellicott, ma'am; something is burning in your room. Please open your door."

"Oh, Dios mio! Maria Santissima! No comprendo! Que quiere?" came in affrighted exclamation from the inside of the room.

Then Ellicott replied in Spanish, "No tenga miedo, Señora; algo esta quemando en su cuarto. Hagame el favor de abrir la puerta."

Ellicott spoke so kindly that evidently Señora Cáramba gathered confidence, for here she opened wide the door. But one couldn't say "Darkness there, and nothing more"; because there was

sufficient light in the room clearly to explain (observe the proper use of the unsplit infinitive, please, and the quotation from Poe's Raven) the terrible, sinister, threatening mystery.

When Señorita Cáramba went to bed she did not know how to turn out the electric light, so, to dim it, she wound her black stocking about it.

The heat of this light scorched and charred the stocking, producing this strange burning odor. But for Ellicott's good, clear sense, the general alarm would have been sounded, and every man in the ship would have believed that thousands of Spaniards were attacking us. It was amazing that such a little, innocent, harmless thing as a stocking could have caused such an uproar. I remember the relief we then experienced, as if we had narrowly escaped from a great danger.

But I must proceed with my tale of inconsequential happenings. The unimportant things that occurred at Manila have been too long neglected.

The *Baltimore* returned to her anchorage off Cavite. In my letters written at the time there is constant reference to the heat. Pitch boiled out of the deck seams. Steam was kept up on all boilers, the engines were kept in constant readiness to move. No awnings were spread. So the ship never had an opportunity to cool off. At night all battle ports were in place, so even then there was no relief below. The days were hot and listless, there was but little work going on, mail seldom came to the ship, so we had but little to do except to think of our physical discomforts, the heat, the uninviting food, the lack of clean linen. At night we would gather in gun sponsons and eagerly discuss rumors, and talk of immediate probabilities.

A few days after the battle, before the 8 a. m. colors were hoisted, a little Spanish gunboat, hardly bigger than a good-sized launch, steamed proudly past our ships towards the Cavite Naval Station; her Spanish ensign dancing gaily to the breeze. A shot across her bow gave her a painful surprise. It was the *Callao*. She had been amongst the Southern Islands and her captain had brought her to Cavite not knowing that war existed between Spain and the United States. So Admiral Dewey cabled to Washington that the *Callao* had surrendered to him.

Secretary of the Navy Long had been much interested in colleges and had evidenced this, when the war broke out, by renaming

two merchant ships chartered by the navy as the *Yale* and the *Harvard*. So, in response to Admiral Dewey's report about the *Callao*, he cabled directions to the Admiral to suggest the name of some American educational institution for the *Callao*. Admiral Dewey answered, recommending the *Callao* be renamed *The United States Ship Massachusetts Institute of Technology*. As the *Callao* would hardly have been long enough to have painted this name on her side, she remained the *Callao*.

Soon warships of other nations came to Manila Bay—British, French, German, and Japanese. We felt the Germans did not have good sea manners. When, during war, a blockade is established, foreign warships by international custom and courtesy recognize the authority of the blockading Admiral, and always go through the form of asking permission to anchor, and to communicate with the blockaded city. This is granted, because a foreign warship is on honor to observe the rules of the blockade, such as not to take anything in or out of the blockaded city, or to deliver or receive mail. But the German ships were careless of such courtesies. I do not know they ever violated the blockade rules instituted by Admiral Dewey, but they violated the usual courtesies accorded the blockading admiral, by anchoring without permission, by having their officers visit the city of Manila without permission. We knew the Germans sympathized with Spain, and we felt they were insolent. On August 12, in response to Admiral Dewey's notification that he would summon Manila to surrender the next day, the German Admiral Von Diedrichs sent word to Admiral Dewey asking where the latter wished the German ships placed during the expected bombardment.

"Anywhere outside of the reach of my guns," was the Deweyesque reply. It was said that von Diedrichs, in true German fashion, scratched his head over this reply and never did understand it.

On Thursday, June 30, the *Baltimore*, which had left previously to meet transports carrying American soldiers, steamed into Manila Bay, leading these army transports. As we passed Mariveles the German squadron, which had steam up, weighed anchor, tailed on to our line, and followed us into Cavite. This was an instance of the German manners of the time. Considering the tense, strained conditions, these manners were resented by us and were considered insolent and unfriendly.

At one time, months later, when the *Baltimore* was blockading the city of Illoilo, the German cruiser *Irene* sent a large landing force, infantry and artillery both, into the city. On that occasion Captain Dyer's language to the German captain was so clear and so expressive that the German captain apologized profusely and hurriedly recalled his men.

No one ever had occasion to misunderstand either Captain Dyer's words or his meaning. There were a number of instances illustrating the bad "sea manners" of the Germans.

On May 19 the Filipino leader, Aguinaldo, had arrived at Cavite. He immediately organized a military force of Filipinos and proceeded to attack the Spanish forts between Cavite and Manila. There were eight of these forts in a distance of 22 miles. One by one they were captured by Aguinaldo, and in a few weeks all eight were in his possession. At this time Aguinaldo was 28 years old. His remarkable victories over the Spaniards were due to his intrepid leadership and the devotion of his Filipino soldiers. Judging the Filipinos by the warfare they conducted against the Spaniards and later against our own forces, with full knowledge of some atrocities committed by them, one may say justly, that on the whole they were and are Christians and gentlemen, true men, and loyal friends.

American soldiers were now arriving in great numbers. It was evident that a campaign was being planned, but no information came to us. And we spent the hot days idly speculating on what was to happen. The Filipinos were now surrounding Manila. Every night we could see the flash of Spanish guns, mounted on the walls of Manila, and hear musketry firing. We were always prepared for an attack on our ships, and had picket boats steaming out, and sentries on board ship on the alert. Every night there were small boats passing about which were frequently fired at.

One night I was sitting in the port after 6-inch gun sponson, talking with Briggs, the executive officer. At about 11 o'clock we heard the reports of several rifle shots.

"Some foolish soldier is loose," remarked Briggs. And then, in the silence of the night, we heard the dip of oars; and soon, dimly off the port quarter, we could see a small rowboat, headed to pass the *Baltimore's* stern.

"Who goes there?" rang out, in stentorian tones, the hail of the sentry. At the same instant a *Baltimore* searchlight was

turned on the boat, vividly lighting it up, and showing in it an American soldier.

"Ogotoel," came from the soldier, in tired disgusted tones. Probably he had not enjoyed being fired at.

"Pass, Ogotoel!" shouted our sentry.

"Sentry," called out Briggs, "What was the answer to your hail?"

"He shpoke in Shpanish, sorr," replied the marine, resuming his watchful beat.

The days were long and hot, and but little news was stirring. But plans were maturing, thousands of soldiers had arrived, and on August 13 Admiral Dewey hoisted orders, and the ships of his squadron got under way and proceeded to attack Manila, following the flagship *Olympia*. From the *Baltimore* we saw American soldiers marching up the beach from the south towards Manila, much of the time wading in water. The monitor *Monterey* preceded these soldiers, firing occasional shells which landed ahead of them and which would have cleared their path if clearing were needed. From the *Baltimore's* deck it looked as if we were to have an interesting day. Slowly we steamed towards the great wall that surrounds Manila. At different parts of this wall were forts, armed with modern 9.4-inch Krupp guns of great power. Manned by trained crews these Krupp cannon could easily and with certainty in a few moments, have sunk every one of Admiral Dewey's small unarmored ships. So we eagerly watched this wall, expecting each moment to see these big guns begin to fire.

But they never began. Our ships moved slowly, stopping at times. I was upon deck. After I had spent some time in wondering why the big guns defending Manila did not open fire upon us, the *Olympia* hoisted a signal; "surely," we thought, "this is the order to begin shooting." But the signal, translated, read: "Do not fire upon walled city unless walled city fires upon us." We were disappointed and wondered what it meant. Then came another signal from the flagship, reading: "Examine southwest bastion of walled city for a white flag."

Officers looked at each other in disgust. "Say," remarked one to me, "this is a joke, a fake, a put-up job." We now understood that the whole thing was a pre-arranged affair; later we learned that the Spanish governor wished to surrender, but insisted on a

show of force. At the time we did not appreciate the fact that the victory is greater if it is accomplished without bloodshed or destruction of property.

The interest in this capture of Manila suddenly left us. It was as tame an affair as could be imagined. I walked disconsolately about the decks. I found a gigantic negro coal passer, Higgins by name, sound asleep in a starboard waterway. I aroused him. "What do you mean," I severely demanded, "by being asleep when your ship is in battle."

"Is this a battle, Mistah Beach? Lawd bless yo! Suh, beggin' yo' pahdon, suh, I thought I heard taps go some time ago, an' it was so quiet I thought everybody had done turned in an' gone to sleep. 'Scuse me, suh, meanin' no disrespec', suh, but I's losing mah respec' fo' Mistah George Dewey. Yes, suh, he suttinly am depreachingating, suh. I kin make mo' noise in a Baptis' camp meeting than Mistah George Dewey is amakin' in this misrable battle. I sholy am dispointed in Mistah Dewey, suh."

Higgins voiced the feeling in the ship.

The soldiers marched into Manila unopposed; Manila immediately surrendered to Admiral Dewey and General Merritt. And the beautiful battle-flag that had been flown from the *Olympia's* mainmast was hoisted over the city. There had been some rifle firing at our soldiers as they entered Manila, but it was not learned who did this.

Previous to the surrender of Manila the Filipinos had organized a government and had proclaimed themselves an independent republic. And they were apparently making good their claim. Fort after fort, city after city, island after island, surrendered to Aguinaldo's forces. Soon there was no Spanish authority anywhere in the Philippine Archipelago.

We ruled and possessed Manila and Cavite with the area of a few square miles, perhaps 50, and a population of 300,000. Aguinaldo ruled and possessed all the rest of the Philippines, with an area of 50,000 square miles, and a population of 7,000,000. Spain ruled and possessed nothing, neither land nor inhabitants. The United States would not recognize the Republica Filipina, which was a bitter, heart-breaking disappointment to the Filipinos.

I am not intending in any way to criticize our action in assuming title over the Philippine Islands because one who was conversant

with all conditions knows our government did what was right and what it had to do. But I am trying to portray the feelings of the Filipinos, as given me in talks by many Filipinos, and by Aguinaldo, both when we were friends, and later, when, for a day, I was his prisoner at the Filipino capitol, Malolos. At the latter time I was a bit concerned, not knowing whether Aguinaldo would shoot me or hang me. I was suspicious of his attentions because of a good lunch he gave me; and of his kindly, gentle words and manner. And still more so, when, after giving me a warm handshake and his autographed photograph, he dismissed me and had me conducted to American lines near Manila. I pondered deeply over this and completely lost my confidence in Aguinaldo and the Filipinos as savages. They weren't living up to what was expected of them.

We now had to conquer the Philippine Islands from the Filipinos, which of course we did. The significant thing that characterized those two years of warfare was that the Filipino Government maintained its organization, and, in large measure, though not towards the end, its power over its troops. These troops fought earnestly, and bravely, and hopelessly to the end. The course of the short-lived República Filipina was creditable and honorable, and Filipinos for all time will regard their ancestors of 1898 with pride and affection.

The Filipinos accepted the peace terms laid down by the United States. A most comforting fact is that since then the Filipinos have believed in the beneficent intentions of the United States. They have learned that the rule of the United States is entirely unselfish; there is no underlying purpose to exploit the Philippine Islands for the benefit of the American interests.

Year by year the Filipinos have seen themselves granted more power in self-government. To-day they control the Governor's Council, the Senate, the House of Representatives, the courts, and practically all details of government administration. They are almost as self-governing as is Canada. They long for complete independence and are confidently looking forward to that being granted them in the near future.

And when the free and independent República Filipina takes an honored place amongst the nations of the earth, the United States of America will have accomplished one of the most unselfish, noble works recorded in history.

DISCUSSION

Did the "Cyclops" Turn Turtle?

(See Page 55, Whole No. 203)

Commander I. I. Yates, C. C., U. S. Navy.—1. In an article entitled "Did the *Cyclops* Turn Turtle?" in the U. S. Naval Institute Proceedings for January, 1920, Lieut. Commander Tisdale, U. S. N., makes the following statement: "The manhole plates of the topside tanks were always left off in accordance with instructions from the navy yard. . . . (I won't mention the yard as I never saw the circular during my time on the colliers) as the air was better for the bitumastic." As the *Cyclops* based at the Norfolk yard, the "navy yard" referred to would mean Norfolk in the minds of many readers of Lieut. Commander Tisdale's article, and it might then be inferred that the loss of the *Cyclops* was partly due to carrying out instructions issued by the management of the Norfolk Navy Yard. It is the purpose of the following article to correct any such possible inference.

Were Instructions Issued?

2. *Other Colliers.*—It is reasonable to suppose that such instructions if issued would not be limited to one collier. Lieut. Commander Tisdale himself intimates that in 1914-1915 the *Neptune* had no such instructions. The commanding officers of the *Jupiter* and *Neptune*, now at the yard, state they never heard of such instructions. Both of these vessels have generally based at Norfolk. Appended is a copy of the correspondence with these vessels on the subject.

3. *Files.*—The yard files are complete for years past and show no such written instructions were ever issued.

4. *Verbal Instructions.*—The following officers and employees now at the yard and who held the positions noted in 1915 and 1916 have been consulted and have stated they knew of no such instructions either written or verbal: The manager, inside superintendent, the ship superintendent for colliers, the chief planner, the planner for painting jobs, the master painter and his force. No one else could have issued them.

5. *Reason Against Instructions.*—At this yard no compartments are coated with "bitumastic," a coal tar product, but this term may have been construed to mean the asphalt formulas which are applied at Norfolk and whose composition is given in formulas 58, 59, and 60 "General Instructions for Painting and Cementing Vessels of the U. S. Navy" issued by the Navy Department. Formula 58 consists of Trinidad asphalt and mineral spirits, is applied cold with a brush and acts as a primer for the

formulas 59 and 60. Fumes are given off for possibly 24 hours, but the solution is not applied without a further coat, being covered by formula 59, "asphalt enamel," which contains 35 gallons of mineral spirits and about 17 pounds of slacked lime to the thousand pounds. The enamel is applied hot with a brush and dries in 5 or 10 minutes. On the deck of a compartment there is added formula 60, asphalt cement, which is applied hot and hardens instantly. After a compartment is finished there is no need for it to dry out further, and in fact the men applying the enamel and cement work in the compartment without protection and without discomfort. There is therefore no reason to leave a compartment open that has been treated in this way.

6. In 1916 when Captain Worley replied to Lieut. Commander Tisdale that the covers were left off to preserve the bitumastic, no bitumastic or asphalt had been applied at the Norfolk Navy Yard to the tanks in the previous two years. In fact, in March, 1917, the tanks were so rusty that the industrial manager authorized scaling, cleaning, and applying asphalt formulas to these tanks, which work was not done prior to the loss of the vessel due to lack of men at the yard.

WOULD INSTRUCTIONS HAVE BEEN FOLLOWED?

7. It is hardly necessary to point out that even had Captain Worley been given instructions to leave the covers off the topside tanks he would not have followed them. In his judgment the safety of his ship would have been of greater importance than the preservation of cement or paint in the tanks. Further every commanding officer of a vessel of the *Cyclops* class that has come to the yard has insisted on having a tight well-deck. At each overhaul the hatches to the cargo holds are gone over to make them tight and also the manhole covers if necessary.

CONDITION OF SHIP

8. When Lieut. Commander Tisdale discovered the covers off the topside tanks the *Cyclops* was in a light condition, and it was immaterial whether the covers were on or off. In fact, in this condition the topside tanks are generally kept full of water. When the *Cyclops* was lost, however, she was loaded over her Plimsoll mark and it is presumed that the covers were secured whether the tanks were full or empty.

STABILITY OF "CYCLOPS" WHEN LOST

9. Exact information as to the stowage of cargo, water and coal on the *Cyclops* when lost is lacking. It is known that she carried 10,600 tons of manganese ore, a very large amount of water, and probably 1000 tons of bunker coal. Had the manganese been secured against shifting by a false deck, shifting boards, or other device the vessel would have had great stability no matter how the water was carried; in fact, the righting arm at 90° would have been at least 5 feet, which would have given a righting moment of 110,000 tons feet with the ship on her beam ends.

10. With the manganese carried at the bottom of the cargo holds the metacentric height would have been so increased that the roll of the ship would have been very jerky and to reduce this it is probable that Captain Worley filled his topside tanks and possibly left a free surface in his double bottom tanks. This would give the *Cyclops* the easiest roll and the least stability, but even so the righting arm at 90° would have been 5 feet as stated above. If however the topside tanks on one side were full and on the other were empty the righting arm would have increased at all angles of inclination beyond 44. With a roll of 7.2 seconds period, assuming the ship to bury her topside tanks under a 4 foot head of water she would ship but 20.8 tons of water on one roll whereas the tanks on one side hold 926 tons. The only other condition where the topside tanks could prove detrimental would be to assume the ship had a permanent list so that water would continually pour in, but for this list to result it would have been necessary for the cargo to shift and if it once started to slide there is no reason to think the inclination would have stopped at the point of immersion of the topside tanks.

11. The angle of repose of the manganese may be taken as 37°, but with a jerky roll it might start to slide at a smaller angle of inclination of the ship. If the ore were not secured and it did start to slide at the end of a roll it would continue to slide at the next roll on the same side, and at some inclination between 50° and 60° the ship would have lost all her righting moment. The condition of stowage water ballast in bottom or topside tanks would have had very little effect had the ore once begun to shift.

CAUSE OF LOSS OF "CYCLOPS"

12. With the data at hand it is impossible to arrive at a definite conclusion as to cause of the loss of the *Cyclops*, but from the fact that no wreckage has been discovered, no drifting boats seen, no radio call received it is probable that her end came suddenly. The theory that due to faulty loading of her cargo she may have broken in two and sunk does not fit the facts that no trace of her can be found; for had she broken, one of the ends would probably have floated long enough for some life raft to have been rigged or other wreckage remain on the surface. We thus arrive at the same conclusion as Lieut. Commander Tisdale that she probably "turned turtle," but for the sole reason that her cargo shifted and without considering any effect of her topside tanks. In fact it is reported that she carried 4000 tons of water and that necessitates her topside tanks on both sides being full as they carry 1852 tons and the remainder of the tanks, *i. e.*, reserve feed and all other inner bottom tanks, hold only 2044 tons in all. The only objections to the theory are first that Captain Worley would not have sailed without securing the ore against shifting, the answer to which is that in war time he may have considered it worth while taking a chance, and second that no unusual weather was reported along the *Cyclops'* track when lost, the answer to which is that it would not take much of a sea to build up a roll of 35 to 40 degrees for the *Cyclops* as loaded.

APPENDIX

CORRESPONDENCE WITH "JUPITER" AND "NEPTUNE"

INDUSTRIAL DEPARTMENT, UNITED STATES NAVY YARD,
NORFOLK, VA., February 3, 1920

To: Commanding officer, *Neptune*.
Commanding officer, *Jupiter*.

Subject: *Cyclops*.

1. In the U. S. NAVAL INSTITUTE PROCEEDINGS for January there is an article which states that the *Cyclops* had instructions from the navy yard to leave off the manhole covers from her topside tanks as the air was better for the bitumastic.

2. Information is requested as to whether in your experience on these colliers you have ever received such instructions. It is further requested that you read the article and supply any facts bearing on the case.

I. I. YATES, Acting.

U. S. S. "NEPTUNE," NAVY YARD,
NORFOLK, VA., February 4, 1920

From: Commanding officer.
To: Industrial manager, navy yard, Norfolk, Va.
Subject: *Cyclops*.
Reference: (1) Ind. manager's letter 31103-4/GAA-1/FA8-3/Fa-C of 3 February, 1920.

1. In the autumn of 1910 I put the *Cyclops* in commission at the Norfolk yard as executive officer under Captain Worley, who was the original commanding officer. The *Cyclops* had just been delivered from Cramps and was unusually well built, in fact Cramps lost money in building her, and no caulking of seams or butts was found necessary after her first cruise to Europe to coal the Squadron at Kiel. The *Cyclops* was the most seaworthy of her sister ships, but she rolled to wide angles. In August, 1911, I was transferred to command the *Nero*, in August, 1917, to command the *Jupiter*, and in November, 1919, to command the *Neptune*. In all my experience on the colliers I never heard of instructions to leave the covers off the topside tanks and in fact they were always kept on unless men were actually at work in the tanks. When the vessel is light the topside tanks, except two, are kept filled to lessen the stiffness and cause easier roll. When the vessel is loaded, but not too deep in the water, the covers on the topside tanks are kept on the manholes, but the sea connections are left open to let such water run out as may leak in. The tanks are sounded twice a day. Captain Worley was always making jokes and was author of the celebrated "Tame Lion" story of 1910-11 which was given such publicity that the Department wrote him to put ashore any lion he had on board. It is probable that Captain Worley answered Lieut. Commander Tisdale in jest on being taken to task for leaving his covers off.

W. J. KELTON.

U. S. S. "JUPITER," NAVY YARD,
NORFOLK, VA., February 6, 1920

From: Commanding officer.
To: Industrial manager, navy yard, Norfolk, Va.

Subject: *Cyclops.*

Reference: (a) Industrial manager's letter of February 4, 1920, No. 31103-2/FA3-c.

1. In my experience as an officer in the navy colliers from 1907 to 1916, and 1916 to date as commanding officer, I have never to the best of my knowledge or belief received or heard of any instructions to leave off topside tank, or any other tank covers or manhole plates on account of bitumastic.

2. I have read Lieut. Commander Tisdale's article on the loss of the *Cyclops* in the U. S. NAVAL INSTITUTE PROCEEDINGS for January. It is customary in the *Cyclops* type of collier to keep nearly all, or all, topside tanks full, depending on circumstances of ship's trim, when in a light or nearly light condition to ease rolling by reducing the stiffness, and for ballast. Covers to manholes are kept secured. In a loaded condition, topside tanks are used as little as possible, and are kept empty except occasionally for purpose of trim.

3. It is my opinion that if Lieut. Commander Tisdale discovered manhole covers to topside tanks on *Cyclops* open, it was due to carelessness on ship's force part in securing same, and that Captain Worley's remark was made in a joking spirit, as such a remark would be very characteristic of him in such circumstances.

4. As a possible theory of the *Cyclops* loss, in connection with the tanks, I would suggest that in case the *Cyclops* cargo shifted, which seems probable, and the ship listed, topside tanks on the opposite side were used to righten her, and on her reaching even keel slack water in double bottoms worked to that side and caused her to "flop" over that way and possibly capsize. It has been my experience in righting ship by means of topside tanks, if she is allowed to come to even keel, she will almost invariably go over the opposite way.

H. M. BOSTWICK.

U. S. NAVAL INSTITUTE

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ANNAPOLIS, MD., MARCH 15, 1920.

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PROFESSIONAL NOTES

PREPARED BY

LIEUT. COMMANDER WALLACE L. LIND, U. S. Navy

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FRANCE

FRANCE'S ONE HOPE OF SURVIVAL.—Of very timely interest is Professor Paul Mantoux's graphic description of the rise and possibilities of France's Second Colonial Empire. Stripped of almost all her overseas possessions at the close of the Napoleonic wars, France acquired in the eighty years following 1830, when the first Algerian expedition was embarked upon, a colonial estate more than twenty times as extensive as her own home area and possessing half as large a population again as is contained within her own territorial limits. The French authorities have governed this vast domain ably and sagaciously and by their humane policy and their ignoring of the color line have succeeded in winning the affection of the natives to an unusual extent.

While France, led on by her ambition to play a great rôle in the world, has been thus extending her colonial dominions in Africa, Asia, and Australia, her stationary population has rendered it impossible for her to people her newly won possessions with French settlers. More than a century ago Napoleon remarked that what France needed above everything else was more mothers, and his saying is more than ever applicable to-day. For many decades there has been a steady and disquieting decline in the French birth rate so that the native population has barely held its own. In eight of the twenty-five years preceding 1914, the number of deaths in France exceeded the births. With a record of one person in twenty-seven killed in action France lost a larger percentage of its total population on the battlefield during the war than any other belligerent. To this total must be added the excess of deaths over births among the civilian population, which in the unoccupied parts of France reached the huge figure of 1,272,765 between 1914-18. Despite the reannexation of Alsace-Lorraine, France is less populated now than before the outbreak of hostilities and has fewer people to-day than Italy with her enlarged boundaries.

Although all indications point to the gradual dying out of the French native stock in France itself, Professor Mantoux believes that she will be enabled to retain her present rank among the great powers of the world through the growth of a large white population in her North African colonies. Already one million persons of European descent are to be

found in Tunis, Algeria, and French Morocco, where the climate and soil are such that white settlers can thrive and where there is plenty of room for many millions of additional inhabitants. But owing to the thinned ranks of her own people, France has no colonists to spare. If any considerable migration of whites to the Northern shores of the Mediterranean should take place hereafter, Spaniards and Italians would undoubtedly predominate among the immigrants while the French element would be but sparsely represented. France may succeed in retaining control of all her North African possessions and in imbuing the inhabitants with French ideas, but with her perhaps permanently reduced population she will not be in a position to people them with a hardy French peasantry. Until the French people give up their present predilection for small families and begin to have more children, it is chimerical to dream of a great French colonial empire teeming with millions of loyal French citizens.—*The Nautical Gazette*, Feb. 7, 1920.

FRENCH NAVY NOTES.—*Program of the New Ministry: The Strong and Weak Points of the New Scouts: Admirals at Variance.*—Premier Millerand has selected Mons. Landry (45), député for Corsica, to replace Mons. Leygues at the head of the Rue Royale administration. This is the ninth change of Marine Minister since January, 1914. It means that there is apparently no cure for the ridiculous governmental instability which is at the root of France's political evils and gradual decline, and it is truly a ludicrous spectacle to see so great a nation trifling in this way with its vital interests. With a system of that sort, that can but fill the Boches with merriment and hope, efficiency and a good return for the maritime expenditure are, of course, totally out of the question. Politicians are replacing one another with such feverish haste in the "fauteuil du grand Colbert" that even if they possessed competence and managing aptitude the result could be but negative—which, of course, it is, our Republic getting less for her money than any other great Power. Moreover, where the head is wrong, it is futile to expect the body to be right, and it is a damaging fact that "Monsieur le Ministre de la Marine" should enjoy so very little prestige and authority in and out of the service, and be a figurehead, more than anything else, and a "passing guest" without lasting influence for good. No wonder a mild spirit of anarchy should prevail both in the command and rank and file of the fleet, and that a feeling of discouragement should assail the hard-working partisans of French maritime renovation. Still, Old Gaul is historically the land of wonderful recuperation and of surprises, and the assets it has acquired through the war are so great that it has yet good chances to muddle through to naval greatness.

The choice made by Premier Millerand has elicited general surprise, Mons. Landry being a newcomer on the political scene and having apparently to his credit no public achievement justifying the high honor and heavy responsibilities conferred upon him, outside of being a personal friend of our eminent President du Conseil and of having a reputation for method and work power, qualities which up to the present he has applied exclusively to the study of economic questions. Yet in some quarters this very ignorance of naval matters is welcomed as the best possible qualification for a civilian Minister, and it is recalled that the politicians who in the past have done most harm to the navy were worshippers of ephemeral crazes, such as Lockroy and Pelletan, who entered Rue Royale, not to construct, but to destroy and paralyze. It is certain that Mons. Landry may learn much and do much good during the few months he is likely to spend at the Paris Admiralty, all the more so as he will have a highly competent guide in Mons. Millerand.

Totally erroneous is the idea that the selection of a hard-working but rather inconspicuous personality to fill so important a post is the result of a disregard of the vital importance of a maritime renovation. Premier Millerand, it must not be forgotten, is the late president of the powerful

Ligue Maritime, an avowed partisan of a greater navy, who spared neither time nor effort to convey to his countrymen his belief that "l'avenir de la France est sur mer, dans le vigoureux développement de ses interêts maritimes et coloniaux." The truth is that the welfare of the maritime militaire is foremost in his preoccupations, and that, once the respected ex-President Poincaré has replaced him in charge of the Foreign Affairs, he intends to devote the best of his ability to promoting, in a practical and businesslike manner, the cause of maritime expansion. He is of opinion that the naval problem is all one, and that there can be no bonâ-fide maritime militare without a thriving mercantile fleet. It is understood the Leygues naval program is to be revised and enlarged, and especially the six 5200-ton scouts and 12 destroyers-éclaireurs that were originally to be completed in four years, will be pushed forward with energy so as to become available in little over two years hence. Should circumstances warrant it, two battle-cruisers of the super-*Hood* type (so far as fighting power is concerned), estimated to cost over £8,000,000 apiece, will be commenced. Training conditions in the fleet, now the object of so much criticism, are to be improved, and the aerial problem is at last to be tackled in a broad-minded spirit, whilst useless expenditure, that is now crippling the navy, is to be further reduced. Startling decisions may be reached concerning the State dockyards, that are doing excellent work for private firms, and could with advantage be gradually turned over to industry.

Interest attaches to the final design adopted for the new éclaireurs of 5270 tons that embodied over the original 4500 tons more improvements than appear on the surface. The all-round structural strength has been improved as well as the water-lines, after a series of comparative experiments. The motor power has been raised from 45,000 to over 50,000, and, judging from the results obtained with the latest British scouts, the speed will be well over 30 knots. The part allotted to boilers and turbines has been liberally calculated, and, although Gallic constructors cannot boast of possessing anything like the experience of British motor specialists, no misgivings are entertained concerning the future career of the Lamotte-Piquets. The armament is nominally the same as before, but the distribution has been happily modified, in conformity with the teachings of the war and the British up-to-date practice. No weapons are left on the sides. The eight guns of 5.5-inch of 55 caliber length (new 1918 model) are concentrated on the axial line, in four gun positions behind twin shields. The gain is substantial both from the offensive and defensive standpoints. It means higher command, and the possibility of training four guns end on and eight broadside, together with better control of fire and quicker rate of shooting. The personnel will be better protected and casualties will be more easy to replace. The guns will offer a smaller target to aerial bombs and will not be exposed to raking fire. Mount-charges and magazines are in the center of the ship, far removed from the sides. Every effort has been made to minimize the consequences of eventual submarine explosions. The 2000-ton scouts will carry four 4-inch guns on the axial line like British super-destroyers, and have an ample motor power for their designed 35 knots. Thus, two years hence, the Republic will have regained the supremacy for speed in the Mediterranean, which is acknowledged to be a vital matter, and the construction is further advocated of four 25-27-knot liners of the improved *Mauretania* type, to be built with the help of state subsidies. Supremacy in speed is what France is aiming at. Constructional facilities are, of course, inferior to the English, but the tried Gallic engineering skill and inventive power have also to be reckoned. When the policy of the states is considered, naval rivalry is seen to take more and more the shape of a contest for speed. A revolution has taken place in French opinion on that score.

This same research for speed is responsible for the minor modifications made to the motors of the dreadnoughts in commission, that have benefited

in many respects since the armistice. The 24,000-ton *Bretagnes* and *Frances* are to carry a supplement of 450 tons of oil fuel to be stored in their double bottom and in some of the space previously allotted to coal bunkers, which will mean an extension of their radius of action and a higher continuous sea speed. Radius of action has somewhat lost its prestige since the war, at least so far as battleships are concerned, but, on the other hand, the drawbacks of coaling in war time have been brought home to French naval men, and the unanimous demand is for liquid fuel, and for a gradual adoption of Diesels for all classes of ships. Private firms are making in this respect a series of experiments that will supply valuable data.

Whereas previous to the war our naval men had sought a remedy to spasmodic efforts and successive crazes in the adoption of a doctrine navale, of a definite naval gospel to be forced into the mind of all those pretending to a sea career, they have now seen the error of their ways and appear to be anew convinced that uniformity and unity of views mean stagnation, active divergence of views and controversies being the true road to progress and the source of emulation and research. So squabbling has started anew in real earnest and divided the upper circles of the navy into two rival camps. Arguments are being exchanged and even administrative blows, but, of course, without bitterness. Adml. Bienaimé, when a député, was of opinion that Admiralissimo de Lapeyrère deserved to be court-martialled for allowing the *Goeben* to escape and for other capital sins. His successor, Admiralissimo Dartige du Fournet, was similarly dismissed for his share in the Greek incidents, and ever since pleasant fault-finding with fleet commanders has been going on in the Paris Conseil Superieur. Lively scenes have at times taken place, especially when our distinguished admirals sat round "le tapis vert" to talk over the lessons of the war and "la politique navale de la France de demain." But all these storms, it is pleasing to note, have not been in vain. The sexagenarian representatives of the marine of yesterday have scored heavily—for a time—in obtaining that the eloquent Minister Leygues, just before making room for another politician, should compulsorily place on the retired list "sur leur demande," Chief of General Staff Ronarch (55), the Dixmude hero, who has rendered such conspicuous services during the war and since, and Rear Adml. Daveluy, our most distinguished naval publicist, the French Mahan. This was an urgent task which Mons Leygues felt he could not decently leave to his successor. Variety of views also prevails in the command of the Armée Navale, where changes are expected.—*The Naval and Military Record*, Jan. 28, 1920.

GREAT BRITAIN

NAVAL POLICY.—The following is an attempt to examine and discuss briefly, in broad outline, the considerations that should govern British naval policy in the future.

As stated in a leading article in the *Times* about three months ago: "The British Empire is an association of states whose highways of communication are ocean highways. This is the justification of the British fleet."

It could not have been better expressed. The natural corollary is that the primary function of the navy is to ensure safe communications, and it is from this point of view that the subject is treated.

It therefore follows that the question—How can this best be effected?—must be answered.

This question in its turn invites other questions: What are the dangers likely to threaten our communications in future, and at what point or points? The reply to the latter question is obviously the province of the statesman.

The duty of the naval staff is, having been fully informed as to dangers real and potential, to calculate the forces required, and then to make the necessary dispositions.

The general opinion before the late war opened our eyes, was that war against commerce could never exercise a decisive influence on the conduct of a naval campaign. This opinion was largely the outcome of the teachings of the late Admiral Mahan. It must, however, be realized that Admiral Mahan did not visualize the potentiality of the submarine, or its use in unrestricted warfare against commerce. In fact, very few did realize this owing to the general belief that so-called civilization could not sink to such a level.

Once having been adopted, and, moreover, having nearly succeeded, ruthless submarine warfare must be reckoned with in the future.

History has a habit of repeating itself, and the fact remains that had Germany been as ruthless in building submarines as she was in using them, we should probably have lost the war entirely through her successful warfare against our sea-borne commerce. We have it on the evidence of Admiral Sims—and others know well—that we were within an ace of going down in 1917 from that cause alone. This indisputable fact is, however, not yet sufficiently appreciated by the navy as a whole.

Combined with the knowledge of what a tremendous weapon the submarine puts into the hands of even the weakest Powers, this should cause those responsible for our naval policy to ponder deeply, whether the League of Nations becomes a living force or not. That it also places a weapon in our hands goes without saying, but being an association of states with ocean highways, it is its employment against us which counts for most.

Fortunately, there is ample time for hard thinking. Much of the naval work in the next few years must consist of staff work. What lines should such thought take?

The broad naval lessons of the late war are already fairly obvious—vulnerability of our sea communications and the absolute necessity of keeping them open. The naval problem is an exceedingly easy one to state, but a mighty difficult one to answer. Still, a problem correctly stated is a problem partly solved. What of new inventions?—of the air? Will they render it impossible for surface ships to keep the seas in time of war? Notwithstanding various polemics to the contrary, it is submitted that the answer is—Yes, very possibly, but not in our time.

What has to be done is to ensure security during the life of the present generation, at the same time laying down the foundations for the security of the next. The edifice may not be the same, but if the foundation is good it will sustain it.

Not for one moment should the products of scientific development on, under, or above the water be lost sight of, and it is naturally the duty of the Admiralty to be continually on the alert as regards new inventions and experiments. The application of such developments to sea warfare must also be closely studied. In this respect it should be a rigid rule that, when any particular offensive or defensive device is being developed, its antidote should be evolved alongside it.

Neglect of this simple rule has cost us dearly in the past. If not observed in the future it may lead to disaster.

The fact, however, remains that, while our overseas commerce is carried by vessels which proceed on the surface of the sea, the greater part of the protection afforded must be provided by surface craft, or at all events by craft which can function on the surface.

Certainly attack may come from craft on, under or above the sea, and it may be argued that our defending craft should be in the air, as it is only from that element that a counter-attack to all other forms of attack could be delivered. This, on the face of it, appears logical enough, and is, except for the fact that sea-borne commerce proceeds in all weathers thousands of miles from land. The submarine is also now practically independent of weather and distance.

These considerations rule out the possibility of relying entirely on aircraft defence, for the present at all events.

The larger surface vessels employed in the protection of commerce should undoubtedly carry aircraft for attack and defence purposes.

Strong air forces will also be a vital necessity at all strategical points in our possession, especially in the focal and restricted areas of our main lines of sea communications.

Sea power is our national safeguard, and will remain so for some years to come. Combined with that of the United States it is hoped that it may be the safeguard of the world.

Sea power in its broader sense has made the British Empire. It binds it together and, let us hope, will continue to do so. When he sees the white ensign, the isolated Britisher feels secure, and it has long been regarded as standing for justice and right the world over. Trade also follows the flag. Sentiment counts for a great deal even in these days.

Let us hesitate, therefore, before being led away prematurely by visions of its supersession by air power. Sea and air power combined! Yes, but sea power first!

Rightly used, sea power should not cause jealousy amongst other nations. Competitive building—two power and other standards—let us sincerely pray that they are things of the past. A fleet based on one's interests at sea and utilized in the interests of humanity—surely no one can logically take objection to that. No one, except criminals, condemns the council of a great city for taking adequate steps to police the thoroughfares.

The police certainly guard property and arrest offenders, but they also do many humane acts, and it is particularly for those acts that they have the affection and respect of the general public. So it should be with the British fleet.

It is hoped that the British fleet of the future will be a truly imperial one, to which all parts of the Empire will contribute in the correct manner and in proportion to their defensive requirements.

In speaking of the British fleet the term must be understood to embrace all the auxiliary services which played such an important part in the late war.

Local defence squadrons and organizations were generally regarded with disfavour in the years immediately preceding the war, although earlier the case had been different. The nature of the late war, and primarily the establishment of the submarine as a decisive factor, has clearly manifested that local naval defence schemes, with the requisite forces to operate them, without assistance from the Mother Country beyond a sprinkling of highly skilled officers and men, are essential. It is not thought that any future war which can be visualized will reverse such requirements. Services such as anti-submarine and minesweeping, for instance, to be of any value must be capable of being brought into effective working order immediately danger threatens. If this is not the case, immense damage will be caused at the outset. It stands to reason, therefore, that they must be organized and trained locally in time of peace.

Sea communications can be rendered secure by two methods. The first, by seeking out and destroying the force which threatens them. The second, by protecting focal areas, patrolling trade routes, or providing convoys and escorts. If it can be employed, the first is obviously the best, being sharp and final. The second aims at protecting one's own shipping and at the same time harassing and worrying the enemy at every point, consequently it is a lengthy business.

Even if the first method is decided upon, the second is partially necessary until the enemy has been sought and destroyed.

Scientific development of passive means of defence will render impossible the traditional method of seeking out and destroying by naval means an enemy's forces behind their defences. It was so in the late war as regards Germany, although we have seen it resorted to in a limited degree in the case of Kronstadt a short time ago.

Since early in 1917, until the armistice, our dispositions aimed at annihilating the enemy's fleet if it emerged beyond its defences, at the same time affording the maximum protection possible to our commerce from sporadic attack by submarines or surface craft.

This in effect was a compromise between the two methods. In the event of our being unfortunately again involved in a war with a Power possessing capital ships, it would seem to be the soundest policy to pursue.

The fact remains, however, that war against commerce affords the greatest chance of success when directed against this country. As before stated, such form of war can be waged by any country which possesses, or can afford to build, submarines. Further, is the revival of piracy, with submarines in the place of schooners, an impossibility?

As regards capital ships, we should have no need to worry for some years to come.

While we remain a sea power we shall always require a striking force, composed of the best gunned and engined vessels that naval architecture can produce. The line of development in this direction points to evolving an unsinkable vessel whose vitals are reasonably well protected from air attack, possibly also submersible.

Due economy must be studied and rigidly enforced. The art in making naval and military provision for possible eventualities lies in obtaining the maximum efficiency with a minimum of expense. No thinking man will grudge or question a reasonable rate of insurance for our vast interests, but he does expect the experts, like those in the insurance business, to calculate the risk and fix the premium accordingly.

The late war has proved one important thing which, if wisely developed, fostered and encouraged, should considerably reduce expenditure. That is, the possibility of the rapid expansion of ships and men in case of emergency.

It would be extremely dangerous, however, to build upon this unless it is founded on a very highly efficient regular navy. The navy of the future will of necessity be relatively a small one. Its efficiency should be in inverse proportion to its size.

Only the best should suffice, especially among the higher ranks. It is here that Lord Fisher's ruthlessness must be applied. If the higher command and direction is at fault, costly mistakes, if not absolute disaster, ensue. We cannot afford, nor will the Empire suffer, costly mistakes in the future.

To sum up, the naval requirements of the future would appear to be:

(a) A small, highly efficient regular navy, capable of rapid expension in case of emergency.

This would include the striking force and the mobile squadrons abroad. It would also provide instructors and the higher technical officers and men for local defence and auxiliary organizations.

(b) Local defence organizations of the various dominions and dependencies. These to be so organized and trained that, supported by the mobile squadrons of the regular navy in their respective waters, they would be sufficient to render their sea communications reasonably secure from sporadic attack; or if threatened by capital ships, to hold their own ground until reinforced by the striking force. Wealthy dominions may prefer to maintain their own striking force. Australia is a case in point.

(c) Auxiliary services, including local defence organizations in home waters. These should be so organized as to be able to be put into operation at short notice. The service should be made attractive and, while run on economical lines, should not be starved or treated half contemptuously. It should be regarded seriously as an indispensable portion of the fleet. The work of these forces in the late war entitles them to a very high place in the nation's esteem and to the affection of the navy. The advantages of organizing these services on a territorial basis should not be lost sight of.

(d) Efficient staff work combined with constant experiment and research. Intimate relations and frank discussion of naval matters with the self-governing dominions.

Sound strategical and administrative training of the higher command and the retention of only the very best officers in the higher ranks.

(e) Considered plans and arrangements for the rapid expansion of the fighting forces and the provision of all types of vessels for auxiliary and subsidiary purposes without throwing an undue strain on the resources of the mercantile marine.

(f) A thorough appreciation of the character that future naval wars are likely to assume. Such appreciation undergoing constant examination and revision as the course of events progresses.

The mercantile marine has not been specifically mentioned. To all thinking men it is now part and parcel of the British fleet and the embodiment of British sea power.

Sea power rests on a healthy mercantile marine. The Empire thrives upon it. It is, therefore, the Empire's duty to see that no evil befalls it.—*The United Service Magazine*, February, 1920.

BRITAIN'S NAVAL LOSSES SINCE THE ARMISTICE.—According to an announcement of the First Lord of the Admiralty in the House of Commons on October 29 last, ten British naval vessels have been lost in the Baltic since the conclusion of the armistice, viz., two light cruisers, two destroyers, one submarine, three patrol boats and two mine detectors.—*The Nautical Gazette*, Feb. 7, 1920.

SHOWING THE FLAG.—In accordance with the promise made by the First Lord when he introduced the Navy Estimates in the House of Commons in March last, the Atlantic Fleet is now engaged in a cruise which will last for at least three months and take the ships some hundreds of miles from the waters they have frequented during the past six years. Mr. Long, after explaining how it was then impossible to fix the limits and dimensions of the post-war navy, said that the only plan the board had so far laid down was "that in the future we must be able to show the flag throughout the British Empire." As all students of recent naval history are aware, there is only one way of showing the flag which is strategically sound and correct. That way is indicated by the cruise of the Atlantic Fleet to the Mediterranean. It is also indicated by the voyage of the *New Zealand* under Lord Jellicoe, and by such journeys as that recently made by the *Renown* with the Prince of Wales. Visits to foreign and Dominion ports by such first-class fighting ships whenever they can be spared for the purpose have an excellent effect from the diplomatic standpoint, and must be more valuable in relation to British prestige than the old method of keeping small, obsolete craft scattered all over the world as *stationaires*. The doom of that system was surely completed when the *Königsberg* swooped down on the poor little *Pegasus* at Zanzibar and destroyed her while she was cleaning her antiquated boilers. A great change has been made since the conclusion of hostilities in the composition of the forces regularly maintained on foreign stations; and now, as the complement to this change, the fleet under Admiral Sir Charles Madden is off the coasts of Spain and Portugal carrying out its first spring cruise under the peace régime.

It must be 15 years at least since the principal fleet has been seen in Mediterranean waters. From 1904 onwards there was a gradual transfer of strength from those parts to the North Sea, and although powerful squadrons continued to be maintained in the Mediterranean, first the Channel Fleet and then the Home Fleet succeeded to that premier position, which enabled us to seize the initiative afloat immediately the situation became strained. It will be most welcome to the personnel of the Atlantic Fleet that the removal of the German naval menace has made possible such a cruise as that now in progress, when the grey mists and gales of the North Sea can be exchanged for the sunny waters of the Riviera. If the situation permits, after the exercises which are due to take place

at sea next Thursday, Vice Admiral Sir Sydney Fremantle will proceed with the First Battle Squadron to Malta, and Admiral Madden will accompany this squadron in the *Queen Elizabeth*. A fortnight's stay will be made at the Mediterranean headquarters, during which time the Second Battle Squadron under Vice Admiral Sir Arthur Leveson will be at Gibraltar. It is not clear, in view of the situation in South Russia and the movements necessitated thereby, whether the Atlantic and Mediterranean squadrons will meet for combined exercises such as those which were held off Lagos in pre-war days, but if it is possible to hold such maneuvers their value will be unquestionable.

Another indication of the way in which the new Admiralty policy of showing the flag is being carried out has been afforded by the cruise of the South American Squadron recently under Rear Admiral Sir Allen Hunt. It will be remembered that in the revised limits of the naval stations published last June, the east and west coasts of South America were thrown into one command, the new station including the waters off Brazil, round the Horn, and off Chile and Peru, nearly up to the equator. These wide limits for one station, coupled with the allocation to it of only three ships, but those of modern type and speed, afford a great contrast to the old distribution, under which the tendency was for ships to become fixed to particular bases. This would be particularly inadvisable nowadays, when it is not certain of what the ultimate force on a station will have to be composed. During December, Rear Admiral Hunt, with the *Southampton* and *Dartmouth*, visited Talcahuano, Iquique, and Valparaiso, and the ships have since proceeded to Callao, Mollendo and Arica, Port Stanley (Falkland Islands) and South Georgia. Moreover, the *New Zealand* is visiting the West Indies; and the *Renown* visited ports in this vicinity and in South America last autumn while the Prince was touring in Canada. Thus the White Ensign has been well displayed of late in the waters of our South American friends.

The interesting group of ten vessels which, headed by the light cruiser *Colombo*, left England last week-end for China draws attention to the transformation effected in the force on this station since 1914. Practically all the new units out there were built while the war was in progress, so that the squadron is more up-to-date than for some years past. The flagship *Hawkins* represents the last word in the design of light cruisers for foreign service; "C" class vessels compose the Light Cruiser Squadron; the Torpedo Flotilla is to contain new destroyers of the "S" type; and the "L" class submarines allocated to the station, like the gunboats which will show the flag in the Chinese rivers, were all newly built during the war. One difference between the new force and the old is that the former includes no large armored ships, as the victory of Admiral Sturdee at the Falklands removed the menace of the *Scharnhorst* and *Gneisenau* with which we were faced in 1914.—*The Army and Navy Gazette*, Jan. 24, 1920.

AMERICA'S ABSTENTION FROM EUROPEAN OBLIGATIONS.—The withdrawal of all American troops from Europe and Asia in accordance with the policy of abstention from active participation in the Peace settlement, which has been forced upon the United States Government by the non-ratification by the Senate of the Treaty of Versailles, is particularly unfortunate at the present time. It has so happened that the coming into force of the Peace Treaty should have synchronised with the complete and utter collapse of national resistance to the Russian Soviet Government, whose victorious armies are said to number now two millions of men, well equipped and well commanded. In these circumstances, it is natural that French opinion should be somewhat troubled over American non-action, for which, it would seem, President Wilson is likely to become the scapegoat. Instead of a good man struggling with adversity, the American President has come to be regarded as a man who, ambitious of immor-

tality as the precursor of the millennium, robbed France of material guarantees for a lasting peace by the substitution of an emasculated Society of Nations, at the first meeting of whose Council in Paris, on the 17th inst., at the Quai d'Orsay, the United States was unrepresented. We are still a long way from the millennium, it is to be feared, and Man is yet somewhat of a predatory animal.—*The Army and Navy Gazette*, Jan. 31, 1920.

IMPERIAL READINESS FOR WAR.—It is obvious that our organization for waging war as a world-wide Empire will have to be remodelled to meet the altered conditions of the world due to the gigantic conflict between nations which lasted from 1914 to 1918, and the fighting which is still going on in Russia.

There must be a central imperial authority for the higher direction of the Imperial forces in war—say a Ministry of Imperial and Federal Defence, which will study the problems of a war conducted simultaneously on more than one front and by air, on land, and on and under the sea.

This Ministry will include within it functions those of an Advisory Committee and of an executive, whose duty it will be to carry out in war the plans which they have prepared in peace—an Imperial Defence Staff—in order that the best results may be obtained from the team-work of the Imperial and Federal Forces wherever they may be raised or however they may be utilized, and whether belonging to Great Britain or to our overseas Dominions and India. Without the co-ordination and the welding together of our widely distributed forces and military assets into a weapon capable of direction as regards strategic action by one central executive, much of the Imperial sea, land and air power may be misdirected or frittered away by unprofitable methods and applied in wrong directions.

It goes without saying that since systematic preparation for war is the best insurance against it, and prestige strengthens the hands of those who have to direct our foreign policy, the Imperial Defence Staff should be recruited from the best brains within the Empire, and appointment thereto should be made indifferently from members of the British Regular Forces or those of the forces of our Dominions overseas, regardless of any other consideration; further, that the emoluments should be such as to be worthy of acceptance by men of talent and ability who could earn good incomes in other professions or in business.

This is necessary, because only by ensuring the representation on the Defence Staff of every British Dominion and of India could we reckon on the fullest moral and material support of the governments and peoples of each component state within the Empire, and cause them to realize the important fact that the Ministry of Defence is an organization working for Imperial purposes in the widest sense. Although its headquarters would be situated in England for convenience of direction, it would have its war staff as much as that of Great Britain, even as the King is their King, embodying in his person the all-British Imperial and Federal authority, under whose orders their forces would serve, and that the fighting forces of Great Britain would receive their strategic instructions from the same Imperial authority which issued similar directions to the forces of the overseas Dominions.

The Imperial War Cabinet, which included Dominion representatives, and as far as British activities were concerned was responsible for the higher direction of the war against the Central Powers and their allies from 1917 to the conclusion of the armistice, was a long overdue constitutional development and a political and military expedient, which for the time being only took the place of a Ministry of Defence, but we may learn from their experience that the whole industrial and financial assets of the Empire may be utilized directly or indirectly against an enemy. Consequently an Imperial Defence Staff must be kept informed as to the whole field of Imperial policy. They may also have to study the effects which

may be produced during war by blockade, by measures of industrial, agricultural or commercial significance, such as the control of transport, raw materials and labor distribution, the special fostering of certain key industries and the development of food supply and food production within the Empire.—*The Army and Navy Gazette.*

WARSHIPS' COMMISSIONS.—A very intricate problem was touched upon by the recent Admiralty order inviting the respective commanders-in-chief and senior naval officers to ascertain and report the views of the service in regard to the length of ships' commissions. The mere fact that the board, before coming to a decision on the proposal, which has been in abeyance during the war period, to re-introduce three-year commissions, should be desirous to learn the opinions of the service generally is indicative of the complex nature of the question at issue. As most readers are aware, several schemes for regulating ships' commissions have been tried in the past, and as the subject is again up for discussion it is timely to review certain features of these systems, since the more that is known about them the better equipped will be those concerned to give an opinion if consulted in the matter.

Until about sixty years ago, or soon after the introduction of continuous service, there appears to have been no system at all in regard to the period during which a vessel was kept in commission. Ships remained on their stations with the same crew—or nominally the same crew—for as long as they might be required. The custom at the time of the old war was revealed on one occasion by Admiral the Earl of Dundonald, who in a speech in Parliament just over a century ago referred to a list of ships of war then in the East Indies, which showed that the *Centurion* had been out there for eleven years, the *Fox* for fifteen, the *Sceptre* for eight, and the *Albatross* for twelve. That state of things will, of course, never occur again. It was not only hard upon officers and men, but it was bad for a vessel's efficiency. The length of time a ship's company were supposed to have been together was no guide to her fighting capacity. Thus in the list quoted by the Earl of Dundonald, there was the *Rattlesnake,* which had recently come home from the East Indies after a fourteen-year commission there. Nominally, she had the same crew, but actually there was only one man left of her original ship's company. Even if the original crew, or the majority of its members, could have been kept together throughout so long a commission, it could not have been expected that, in the ordinary way, their efficiency would have been maintained. Officers and men would have begun to get "stale," and the battle-worthiness of their vessel to have deteriorated accordingly. On all grounds, therefore, this old custom of letting ships' commissions settle themselves, according to the circumstances of the time, stands condemned.

In considering what should replace it, two things seem, as far as possible, to have been aimed at—the fighting efficiency and readiness of the ship, and (without which the former cannot be obtained) the contentment of officers and men. Up to a certain point, the first aim was furthered by keeping the same crew together for as long as possible, in order that they might know and understand each other, and be trained together in the handling of the machinery entrusted to them. The second aim, on the other hand, was promoted by giving the personnel as frequent opportunities as the exigencies of the service would permit of returning to enjoy the blessings of the land with the fruits of their labors. When first inaugurated, three-year commissions answered these requirements fairly well. Compared with previous practice, they were a great boon. In the early years of the present century, however, the feeling grew up that a shorter period would be desirable. It was considered that owing to the high pressure at which life in the modern navy was lived, a certain staleness or falling off was to be expected after two years in the same ship, while as regards foreign service, a three-year term, when the means of transport and

communication had improved so much, was thought to be a source of unnecessary discomfort and dissatisfaction to the personnel and those dependent on them in England. Accordingly, at the end of 1904, it was decided to introduce two-year commissions, concurrently with the inauguration of the nucleus crew system.

Two-year commissions did not work altogether as expected. The idea was that ships with a full complement would receive at the beginning of a new commission a nucleus crew from a reserve ship who had already been serving together for a year, so that the skilled members would in practice remain in the same crew for three years as before. Two-thirds of the personnel of the fleet were to be at sea and one-third at home, so that for every two years at sea one year was to be spent at home. Moreover, the replacement of time-expired men, and other irregular reliefs, was to be made from unappropriated resources in the barracks and not from already formed nucleus crews. In practice, it was difficult to keep to these rules, and complaints were heard that so many ships were utilized to train drafts of young seamen, the coming and going of which entailed a loss of efficiency, although the value of this arrangement was proved when the supply of trained seamen and stokers in 1914 was found to be more than adequate. Above all, however, there remained the fact that after two, as after three, years, there was what Mr. Churchill in 1912 called a grave loss in efficiency and war power in the process of killing the live ship by dispersing her officers and men. It was at this time that continuous commissions were spoken of, but they do not seem to have materialized, and the decision now seems to lie between two- or three-year commissions—between giving officers and men more opportunities for home service and training, or increasing the proportion of ships in a fleet which do not change their crews in the same year.—*The Army and Navy Gazette*, Feb. 14, 1920.

ECONOMY—TRUE AND FALSE.—There is probably no term which is subject to greater equivocation than that of "economy." In the name of a policy of economy there are many people at the present time who would sweep away altogether, or at least curtail considerably, the force which has been the main bulwark of the Empire as long as it has been established. Real economy, however, such as is urgently needed in all public departments at the present time, and has been consistently advocated, signifies a frugal and judicious expenditure of money or material—to make a fixed amount go farthest, or alternately, to obtain what is necessary with the smallest possible expenditure. It would be false economy, and worse, to reduce our standard of naval strength, which is the surest form of national insurance, below what is necessary for safety, and we are glad to see that Admiral Sir Doveton Sturdee took the opportunity recently, in replying for the navy at the Spectacle Makers' Company, to drive this fact home. Greater responsibilities, said the admiral, had been imposed on the Empire for the future, and it was most important they should be recognized. He was a great believer in economy, but it would not be economical to reduce our "police force" at the expense of our security. The country must be alive to the need for distinguishing between what is a fair object for cutting down, such as the surplus ships and establishments left by the war, and what is essential for the future navy.—*The Army and Navy Gazette*, Feb. 14, 1920.

UNITED STATES

NAVAL POLICY

NAVY MUST EXPAND, SAYS GENERAL BOARD.—Rear Admirals Henry T. Mayo, Joseph Strauss, A. G. Winterhalter and Charles J. Badger, members of the General Board of the navy, appeared before the House Committee on Naval Affairs on March 1 and requested that the present building program of the navy, with the additional construction of several more

NAVY DEPARTMENT—BUREAU OF CONSTRUCTION AND REPAIR

VESSELS UNDER CONSTRUCTION, UNITED STATES NAVY—DEGREE OF COMPLETION, AS REPORTED FEBRUARY 29, 1920

Type, number and name	Contractor	Per cent of completion			
		Mar. 1, 1920		Feb. 1, 1920	
		Total	On ship	Total	On ship
Battleships					
43 Tennessee	New York Navy Yard	99.	97.	98.1	95.1
44 California	Mare Island Navy Yard	90.5	84.9	88.9	82.8
45 Colorado	New York S. B. Cpn.	43.4	28.3	42.2	25.9
46 Maryland	Newport News S. B. & D. D. Co.	66.	59.	63.	55.8
47 Washington	New York S. B. Cpn.	41.9	26.	40.3	23.9
48 West Virginia	Newport News S. B. & D. D. Co.	27.	6.6	27.	5.8
49 South Dakota	New York Navy Yard	8.1	.8	7.1	.6
50 Indiana	New York Navy Yard	8.1	.8	7.1	.6
51 Montana	Mare Island Navy Yard	5.9	.7	5.	.5
52 North Carolina*	Norfolk Navy Yard	6.6	1.3	5.3	.9
53 Iowa	Newport News S. B. & D. D. Co.	1.	....	....	....
54 Massachusetts	Beth. S. B. Cpn. (Fore River)	....	....	....	....
Battle Cruisers					
1 Lexington	Beth. S. B. Cpn. (Fore River)	.1	....	....	....
2 Constellation	Newport News S. B. & D. D. Co.	.1	....	....	....
3 Saratoga	New York S. B. Cpn.	.2	.1	.1	.1
4 Ranger	Newport News S. B. & D. D. Co.	.1	....	....	....
5 Constitution	Phila. Navy Yard	.1	....	....	....
6 United States	Phila. Navy Yard	.1	....	....	....
Scout Cruisers					
4	Todd D. D. & Const. Cpn.	42.	21.4	34.3	12.8
5	Todd D. D. & Const. Cpn.	35.4	12.5	32.1	9.3
6	Todd D. D. & Const. Cpn.	26.6	2.3	26.3	2.2
7	Beth. S. B. Cpn. (Fore River)	4.4	2.2	3.9	2.1
8	Beth. S. B. Cpn. (Fore River)	4.4	2.2	3.9	2.1
9	Wm. Cramp & Sons Co.	30.	....	26.	....
10	Wm. Cramp & Sons Co.	27.	....	25.	....
11	Wm. Cramp & Sons Co.	14.	....	12.	....
12	Wm. Cramp & Sons Co.	14.	....	12.	....
13	Wm. Cramp & Sons Co.	14.	....	12.	....
Miscellaneous					
Fuel Ship No. 17, Neches	Boston Navy Yard	58.1	54.5	55.	50.
Fuel Ship No. 18, Pecos	Boston Navy Yard	21.6	7.3	20.1	5.6
Gunboat No. 21, Asheville	Charleston Navy Yard	98.4	97.9	97.4	95.9
Gunboat No. 22, Asheville	Charleston Navy Yard	20.7	17.7	16.	14.
Hospital Ship No. 1, Relief	Phila. Navy Yard	73.5	69.5	70.5	66.5
Amm. Ship No. 1, Pyro	Puget Sound Navy Yard	99.3	98.2	99.2	98.
Amm. Ship No. 2, Nitro	Puget Sound Navy Yard	92.	83.	90.	80.
Rep. Ship No. 1, Medusa	Puget Sound Navy Yard	25.	13.	22.	8.
Destroyer Tender No. 3, Dobbin	Phila. Navy Yard	13.	9.2	12.	7.2
Dest. Tender No. 4, Whitney	Boston Navy Yard	....	....	....	....
Sub. Tender No. 3, Holland	Puget Sound Navy Yard	....	....	....	....

*To be commissioned March 31, 1920.

There are in addition to the above 99 destroyers, 51 submarines, 7 seagoing tugs, and 5 oil tankers in various stages of completion.

There were completed and delivered to the Navy Department during the month of February 6 destroyers, 2 seagoing tugs and 1 oil tanker.

There are 12 destroyers, 10 submarines and 1 transport (No. 2) authorized but not under construction or contract.

ships, be adhered to in the appropriations for the navy. The real power of the navy, said Admiral Badger, who was the first witness, depends on ships carrying guns of large caliber, and the board believes that the present building plan of the navy should stand. It follows a consistent policy. Admiral Badger grouped together the 1916 and 1921 building programs in stating what the board believed the navy needed in the way of new ships, the 1916 program being already authorized. This combined program would call for 12 battleships, 7 battle cruisers, 20 scout cruisers and 2 airplane carriers of the larger types of ships; the smaller classes showing an increase of 4 destroyers over those asked for in the two existing programs. The airplane carriers would carry 8-inch guns and have a speed of 35 knots. The cost would be approximately $23,100,000 for one of these ships, which would resemble the latest type constructed by other naval powers. Admiral Badger said that it was also necessary to add to the construction plans at least one submarine tender and one destroyer. "We are short of scout cruisers," he said. "Those we have are out of date. Our naval increase must depend on the increase of our mercantile fleet. The two go hand in hand. The new scout cruisers will be of 10,000 tons and carry 8-inch guns. We must build more destroyers because for many years we will need this class of craft to combat the submarine and provide a screen for our large ships."

Admiral Badger stated that in order to keep the navy in first class condition it will be necessary also to build more submarines of the type suitable for long cruising radius. "We must consider distances," he said, "when we make plans for building our ships. The recent war demonstrated the efficiency of the submarine. The board is opposed to the wholesale building of submarines, but we believe that we must build certain submarines to keep within the experimental stages." The Admiral enumerated plans for the building of two submarines of the following classes: A submarine capable of long cruising radius, about 300 feet long and to make 14 knots. The tonnage would be 2000 and the type of the vessel would be similar to the large ones, probably of the *Deutschland* class, turned out by the Germans in the late war. Second, a mine-laying submarine of the German *U-117* type; third, submarines of the modern type, from 200 to 250 feet in length and a tonnage between 800 and 1000.

The General Board was in accord with the aviation plans as submitted by Captain T. T. Craven, Director of Naval Aviation. Admiral Winterhalter stated that the bombing airplanes did not make any effectual attack on the fleets of the naval powers in the World War and that he was under the impression that he "could not see at present any danger from this craft in the future." He added that a bombing plane could operate with effect over cities, but thus far there was no tangible or practical basis offered where a fleet will be endangered by aerial bombing craft.

Admiral Strauss was asked to give his impression of the sea battles in the war. "The 3-inch deck plate on battleships," said Admiral Strauss, "serves as a resistance to high explosives dropped from airplanes on shipboard. The war shows that bombing planes have little effect on big ships." He called attention to an enemy bombing plane which, according to press reports, dropped 300 bombs over a French warship in the Dardanelles. Only three bombs hit the ship and practically the vessel suffered no damage. Discussing the battle of Jutland, Admiral Strauss said both fleets came within 5000 yards striking distance, but that the main fire was delivered from a distance of between 10 and 11 miles, which is considered an effective range. "We have been told," said Admiral Strauss, "that the ships lost in the Jutland fight were in some cases sunk by the explosion of their magazines after the ship was hit. We have no practical data on the battle." Admiral Strauss added that it was difficult to say whether the sunken ships had been pierced by gunfire. In the Falkland Islands fight the range was approximately 11 miles, and the elevation in firing

the guns from the ships was about 15°. Where hits were made in most cases the hits registered at 20°, which indicated that the hits were made on the near side of the vessels.

Admiral Badger continued his testimony on March 2 when he stated that the General Board favored establishing an extensive naval base on the Pacific coast. Admiral Mayo was asked to make some additional statements, but said that he was in entire agreement with what Admiral Badger had reported. Mr. Britten pressed Admiral Mayo for his opinion on Mare Island. "We should keep it as a building point because of favorable climatic conditions," said the Admiral. Questioned on the suitability of locating the big base at Mare Island or at San Francisco, Admiral Mayo replied that he did not think it advisable to place it at Mare Island, inasmuch as the water space and channel make it inexpedient to do so. Chairman Butler wanted to hear Admiral Mayo's opinion on the question of consolidating the bases at San Francisco and Mare Island on the ground of economy. Not having given the matter any study and since he was a comparatively new member of the General Board, Admiral Mayo said, he was not prepared to discuss plans from a practical basis in this connection. However, he said, mistakes should be guarded against in selecting sites for navy yards. "A large site for a naval base could be obtained at the outset and it would not be necessary to make a large expenditure on the plant in the beginning, but a modest sum might be expended," said the Admiral.

Mr. Kelley interposed and said that he understood the department would need $60,000,000 to construct a base at San Francisco and that "probably the same sum would be required for Mare Island." Mr. Padgett said that already $29,000,000 have been expended at Mare Island. "Because of probability that this contemplated base for the Pacific coast will require $100,000,000 expenditure in the end," said Mr. Hicks, "it will be necessary for me to have more practical data on the project before I would vote favorably on it." Chairman Butler said everything could not be provided for "in the present state of government finance."

Other Pacific coast developments favored by the General Board, Admiral Badger said, include enlargements of the Puget Sound Yard, development of smaller yards at San Pedro and San Diego and submarine bases at the Columbia river and at Port Angeles.—*Army and Navy Journal*, Mar. 6, 1920.

STATE CREWS FOR NAVAL VESSELS.—The report that the morale of the United States Navy is at a low ebb is doubtful, but the recent reports that efforts are being made to recruit sailors in certain states for service on vessels named after those states seems to be a rather precarious operation.

To outsiders this method of obtaining crews seems to be rather far fetched and makes one wonder what would happen if an occasion arose when it was desired to transfer men from one vessel to another—which is often done in the navy.

Without any information on this subject we cannot help feeling that the Navy Department authorities must be rather hard-put to secure a sufficient number of new recruits when they allow such practice as this to start. On the other hand it may be that it is being done with the purpose of instilling a certain amount of feeling among the sailors so that the ship on which they are stationed, named after their own state, will have a far greater place in their regards than would be the case if they were placed promiscuously on any vessel. Whatever the effect may be it is to be hoped that this movement will be carefully guarded so that only good will come from it.

In these days when such high wages are being offered to men for shore work it is probably very difficult for the enlisting offices to secure their quota.—*Shipping*, Feb. 11, 1920.

MATÉRIEL

HOUSE DISAPPROVES COMPLETION OF VESSELS.—The House on February 28 considered Senate Amendment 34 to the Deficiency Appropriation bill, providing $3,000,000 for the preservation and completion of navy vessels on the stocks and in ordinary. The House had disagreed to the amendment. Congressman Tinkham moved that the House recede from its disagreement to this appropriation and offered an amendment that such parts of the appropriation as in the judgment of the navy may be necessary be applied to the objects of expenditure specified in the appropriations for various bureaus of the department for the fiscal year 1920. The amendment did not prevail. The House then refused to recede and the bill was sent back to conference with instructions that the House insisted on the elimination of the Senate provision. When the bill was returned for a second time from conference this $3,000,000 item was eliminated by the conferees and the deficiency bill agreement accepted.—*Army and Navy Journal*, Mar. 6, 1920.

THE TORPEDO-PLANE.—The successes scored by the torpedo-plane in the North Sea, when the Germans used it successfully against merchant shipping, awoke the naval authorities to the great tactical value of this weapon against warships. Had the war been prolonged this form of offensive would have been used extensively against the German fleet. All of which must be gratifying to that gifted inventor, Admiral Bradley A. Fiske, who had already won great distinction as the inventor of the gun telescope—the foundation upon which modern gunnery has been built up.—*Scientific American*, Feb. 21, 1920.

BATTLESHIPS FOR TARGETS.—The highly efficient Bureau of Ordnance contemplates introducing a system of target practice for the navy which will more closely simulate actual battle conditions. It is proposed by Rear Admiral Earle to take several obsolete ships and use them as targets running at full speed. They would be without crews, of course, and they would be steered by the new method of radical control which has been developed for airplane service. The advantage of this is that the target ships would pursue zigzag or even sinuous courses while under fire by firing ships. The advantage of such a system over the present method of towing canvas targets will be obvious.—*Scientific American*, Feb. 21, 1920.

DISTANT ELECTRICAL CONTROLS FOR MILITARY SEARCHLIGHTS.—It has been found by experience that an observer operating a military searchlight finds it difficult to train the searchlight on the target when he is stationed close to the searchlight itself. The reason for this is that the observer at the lamp is handicapped by the dazzling effect of the bright beams on the eye. On account of this feature of searchlight operation, remote-control schemes have been devised whereby the observer is stationed at a distance of some 500 feet from the searchlight itself and there trains the lamp upon the target by means of electrical control. Theodore Hall, writing in a recent issue of *General Electric Review*, describes a number of schemes, known as potentiometer schemes, in which the field of the operating motor is placed across a certain portion of the rheostat and by means of a dial switch the armature may be connected between the center point of the rheostat and points either to the right or to the left, depending upon the direction of rotation. Diagrams of connections are given for various control schemes in which it is shown how the number of control wires may be reduced by suitable connections.—*Scientific American*, Feb. 28, 1920.

ADMIRAL STRAUSS ON MINE BARRAGE.—When Rear Admiral Joseph Strauss, U. S. N., was before the House Committee on Naval Affairs on March 2 in connection with the General Board's statement of the navy's building program, he was requested to inform the committee on the

work of laying down and of sweeping up the North Sea mine barrage. The Admiral estimated that the barrage accounted for the loss of at least ten submarines. Data prepared by the British Admiralty showed that eight submarines were the toll of the barrage and in removing the mines Admiral Strauss said evidence on certain mines showed that three more submarines were destroyed. Admiral Strauss indicated to the committee by these various evidences that it was not exaggerating to state that ten submarines were accounted for. The barrage was laid within touch of the three-mile zone of an island belonging to Norway, said the Admiral, who added that Norway found it necessary to lay a mine barrage within her three-mile limit in order to stop the Germans from using that sea highway as an outlet.

"What was the percentage of the removal of the barrage?" asked Mr. Butler. "One hundred per cent," replied Admiral Strauss, who stated further that a test sweep covering 864 square miles indicated the truth of the statement since no strayed mines were found. By an international agreement after the armistice each nation agreed to remove its own mines. The United States and Great Britain had planted the largest number. Mr. Butler asked if America had not plans for laying a barrage in the English Channel in addition to the one already laid by the English. The Admiral denied this to be a fact, but stated that plans were drawn for planting mine barrages in the Adriatic and in the Ægean Sea, the latter in the locality of the Grecian Archipelago and within striking distance of the Turkish coast.

In removing the North Sea mine barrage twenty-three subchasers were put to use, he said, and from these rifle fire was delivered at a mine when it came to the surface. Thus hit the mines would ship water, sink and explode. In laying the barrage Admiral Strauss's ships were screened by large vessels which kept the sea clear of the enemy. Had not the sea surface been cleared of the enemy it would have been impossible to construct the gigantic work. Admiral Strauss's opinion on the super-efficiency of armor-piercing shells in comparison with explosive shells was not lessened by the war, but materially strengthened. He confirmed the report that no one was lost in laying the mines. To a question he said that eleven were lost in sweeping the barrage, and that this figure was low compared to that of the British. Mr. Hicks on stating that members of the committee were familiar with the work of the navy over there and had met Admiral Strauss overseas, added: "I want to congratulate you on your wonderful work."

Mr. Kelley questioned the Admiral on the attacks made by the German submarines. "The submarines made several attacks on the Grand Fleet," said the Admiral, "but the destroyers drove the subs off and by maneuvering the ships kept out of the path of the torpedo." While ships are under way Admiral Strauss thought that the submarines were ineffective for attack, although he maintained that America should develop the submarine, as it has its own functions. Mr. Kelley estimated that at the highest Germany had about thirty submarines operating at one time, and the Admiral concurred. He answered Mr. Kelley further by stating that the British had approximately 3000 ships in submarine chasing, but not all were operating at one time. "We had several hundred," added the Admiral.—*Army and Navy Journal*, Mar. 6, 1920.

NAVY BUILDING A RIGID DIRIGIBLE.—The navy is now building at Philadelphia, Pa., and Lakehurst, N. J., a rigid dirigible which will be a composite of the German *L* type and the British *R* type, with certain modifications. This ship probably will not be finished before 1922. The Joint Army and Navy Board which has been working on the problem of airships has come to the conclusion that the proper policy for the United States is to place in the hands of the U. S. Navy all development of rigid dirigible airships to be utilized in the military services. The board declares that

until such time as the navy has developed a proper dirigible program and built dirigibles, the navy should have full control, and that in case of an emergency requiring operation of dirigibles for the army the navy should supply the ships, and operate them for the army. The Navy General Board, it is understood, has decided that the navy should have at least ten rigid dirigibles. However, as there were no funds for so extensive a program matters have been held in abeyance. The question of further appropriation is in the hands of Congress.—*Army and Navy Journal*, Mar. 6, 1920.

U. S. NAVY'S INFLUENCE ON OUR HARBOR SITES.—Rear Admiral John R. Edwards, U. S. N., in a paper read at the recent convention of the American Association of Port Authorities, held at Montreal, Canada, urged the detailing of experienced navy officers as supervisors of our leading seaports. In speaking of the general study of harbor improvements he said: "Special reference is made to the early location of our navy yards, because the action of the navy undoubtedly materially influenced the trend of harbor development of the leading coastwise cities of our Atlantic coast during the past century. The navy is therefore responsible, in part, for the mistaken policy pursued by our leading steamship companies in acquiring sections of the water frontage which were in close vicinity to residential and business centers of communities. The fact should therefore be emphasized that even able and distinguished naval officers of a century ago, men who had traveled all over the world and had opportunity to note the character and trend of harbor development, appeared to have had but little conception of either the eventual vast future extension of commerce, of the trend of design of ship construction or of the enormous demands that would eventually be made upon the water frontage of our leading ports to handle the commerce of the world." Continuing, the Admiral said: "The effective range of heavy guns of the battleship against shore fortifications has been overestimated, and as a result the doctrine has been preached that no great harbor ought to be developed within 10 or 15 miles of deep water. The undue idolatry of the heavily armed and armored battleship has been, in fact, somewhat of a serious detriment to harbor development. If the range of guns of the battleships had not been exaggerated, why was not Wilhelmshaven, and particularly Ostend and Zeebrugge, destroyed early in the war? Is not Wilhemshaven directly on Jade bay, an estuary of the North Sea, and does not the breakwater of that harbor constitute the only land projection between that naval base and deep water? This is an important feature of the problem of harbor development that should be inquired into, for the fact should be kept in mind that the combined fleet of capital ships that could have been assembled by the Entente Powers in an attack upon the German ports of the North Sea would have been double, if not treble, in displacement and gun power of that of the defensive fleet that could have been gathered by Germany."—*Army and Navy Journal*, Mar. 6, 1920.

NAVAL OFFICERS SUGGESTED AS SUPERVISORS OF OUR LEADING PORTS.—Many of our Senior Naval Officers, by virtue of their extended training and experience, combined with their knowledge and study of seaport conditions throughout the world, are peculiarly fitted to be entrusted with the supervision of regulating the traffic of our leading harbors. The efficient regulation of maritime traffic is a problem distinct unto itself, and one intimately related to harbor development. National control of every phase of police regulation afloat should be placed under the supervision of some tactful and experienced naval officer, since such supervision is absolutely necessary.—*Monthly Bulletin of the American Association of Port Authorities*, Feb. 1, 1920.

MERCHANT MARINE

PRESENT AND FUTURE PROSPECTS OF OUR MERCHANT MARINE.—The operations of the Shipping Board are so complicated and are being carried out on such a vast scale that it is rather difficult for the average citizen to understand at any time just where we stand, what has been done, and what we intend to do. Considered as a commercial proposition, the problem is confusing because of the fluctuation in the price of ships and in the freight rates and the uncertainty as to just what Congress will determine to do in the matter of the selling of ships, and the flag under which vessels which are sold will operate.

The latest statement by the Emergency Fleet Corporation of the Shipping Board shows that in 1917 we launched 106 ships representing a total of 708,970 deadweight tons. In 1918, the Corporation launched 812 ships, or a total of 4,244,126 deadweight tons. The record year came in 1919, when we launched 1065 ships, representing a total deadweight tonnage of 5,982,277 tons. Of these total launchings, the Corporation delivered in 1917, 49 vessels, amounting to 302,115 deadweight tons, in 1918, 532 vessels of 3,026,006 tons deadweight, and last year, when we launched 1065 ships, there was actually delivered 1181 ships of a total tonnage of 6,385,123 tons deadweight. There remains of the war construction program, 534 ships of 3,661,767 deadweight tons, which will be completed and delivered by August of the present year.

In addition to this, we either purchased or contracted with Japan for the building of 45 ships of 372,023 deadweight tons. Of these we have actually received from Japan and have now in service 18 ships of 148,323 deadweight tons.

Summing up these activities and the taking over of German and Austrian vessels, we find that the United States possesses 8,700,917 tons of steel ships, 1,799,123 tons of wooden ships, 63,000 tons of composite and 10,000 tons of concrete ships, making a total tonnage of 10,573,040 deadweight tons. Adding to this the 3,661,767 tons to be completed in 1920, we get a grand total of 14,234,767 deadweight tons, or 9,489,511 gross tons.

Now, during the period covered by the operations of the Shipping Board, we have lost through accidents at sea, by reconveyance to former owners or by sale 194 ships representing 1,274,371 deadweight tonnage. Moreover, some of the ships now in operation will be sold for use by foreign flags. Nevertheless, the fleet as a whole, representing 1688 ships, of say in round numbers 9¼ million tons deadweight or 6¼ million tons gross, will be operated under the United States flag as a permanent merchant marine, and will be available to serve the trade routes of the world.

Now it must be clearly understood that this fleet is a cargo fleet pure and simple, at least so far as the ships which were built during the war are concerned. We built absolutely no passenger tonnage, all the increase in passenger ships being due to such vessels as were taken over from the enemy. At present we are building 26 new passenger ships which should be delivered this spring. The War and Navy Departments have turned over to the Shipping Board 27 ex-German passenger ships, but these having been made into troop ships are not in any condition to be used for passenger service, and will not be until they have been re-conditioned. Thus far only one of these, the *Moccasin*, of 3100 tons gross, has been re-conditioned, and she is now in the South American trade. The outstanding problem, however, of the whole question is that of policy, and particularly with respect to ownership and operation. Shall the ships remain the property of the government and be operated by the Shipping Board or by private concerns under charters granted by the Shipping Board, or will it be better policy to sell the ships outright to the highest bidders under long-term payments, abolishing the Shipping Board and leaving the future of our merchant marine entirely to private initiative?

Or, as a last alternative, shall the government retain its new merchant fleet, leaving it under the control of the Shipping Board to be operated for the largest profits than can be obtained and in unrestricted competition, not merely with foreign shipping, but our own?

The *Scientific American* is strongly of the opinion that one of the outstanding lessons of the war is the futility of government ownership and operation of public utilities or great industrial and commercial enterprises of any kind whatsoever. The ships should be sold in the open market to the highest bidder, with the proviso that, except in special cases, they shall not pass under a foreign flag. They should be sold for a certain and considerable cash precentage of the price, the balance of the payments to be made at stated intervals. Furthermore, it would be futile to attempt to sell the ships at their original cost, which to-day is far above the price for which shipping is being constructed in the leading shipyards of our competitors. Last and by no means least in importance, is the crying need for revision of our navigation laws and the removal therefrom of certain very burdensome and entirely unnecessary restrictions.—*Scientific American*, Feb. 21, 1920.

MANNING OF AMERICAN SHIPS.—The total number of masters, officers, and men required at the present time to man the registered, enrolled, and licensed vessels of the United States, including 1450 documented yachts, and aggregating in round numbers 15,325,000 gross tons, is in round numbers 266,000. The *List of Merchant Vessels of the United States* for June 30, 1919, to be issued in March by the Bureau of Navigation, Department of Commerce, shows the number of the crew (excluding master) of the 29,600 vessels and yachts included in the list. Adding the master for each vessel the totals of the list are as follows:

Vessels	Number	Masters and crew
Steam vessels	7,817	156,114
Motor vessels	11,525	42,941
Sail vessels	4,474	24,672
Unrigged vessels	5,853	11,425
Total	29,669	235,152

The new vessels documented since the list went to press require masters, officers, and men aggregating 31,000 in round numbers, making a present total of 266,000.

Our salt-water tonnage is now nearly three-fourths of the total tonnage, but as it includes the larger ships with relatively small crews in proportion to tonnage, the total number required to man our salt-water ships at this writing may be estimated at about 175,000.

On June 30, 1915, the total number of masters, officers, and men required for American merchant vessels and yachts was 187,921, of whom 60,354 were required for seagoing ships. The increase in our seagoing tonnage for the past two years, built with appropriations by Congress, has been wholly in cargo boats, requiring, of course, smaller crews than passenger ships.

For comparison, it may be added that in 1914 the total number of masters, officers and men employed on 12,486 merchant vessels of the United Kingdom, aggregating 20,300,000 gross tons (12,214,000 net tons) was 295,652, of whom 210,672 were employed on 3941 steamers in the foreign trade. Since the beginning of the World War corresponding returns have not yet been published.—*The Nautical Gazette*, Feb. 14, 1920.

THOUSAND-FOOT LINERS ABANDONED.—The abandonment by the Shipping Board of the ambitious scheme of its former chairman, E. H. Hurley, to build and operate two 30-knots steamships, each one thousand feet in

length, is to be commended, first for the reason that there is no call for ships of that size and speed, and secondly because their first cost and the cost of operation would be so great as to condemn them to failure. It will be remembered that the scheme as originally put forth contemplated the creation of a terminal at Montauk and the double-tracking of the Long Island Railroad, with the idea of conveying passengers and mails more expeditiously to New York. The Montauk plan found no favor—if only for the reason that passengers would be unwilling to go to the trouble of a transfer from ship to train, when they could go right through to New York in comfort at the cost of only an hour or two longer on the water.

But the construction of these huge ships at a cost each of not less than $25,000,000, would have been an act of folly at the present time. The Shipping Board has problems enough on its hands just now, without saddling itself with two such white elephants as these ships would prove to be. The element that would be fatal to success would be the high speed of 30 knots, which would involve an enormous first cost in boilers, turbines and auxiliaries, and the huge fuel bill representing, if in coal, not less than 17,000 tons per day. Twenty years ago, when the *Deutschland* first passed the 23-knot mark, she was found not to pay. The *Mauritania* raised the speed to 26 knots, but she burned 1000 tons of coal a day in doing it.

Far more profitable vessels are the 535-foot, 17-knot combined passenger and cargo ships of which the Shipping Board is now building nineteen. Ships of this type afford every luxury of travel and they are sure revenue earners.—*Scientific American*, Feb. 7, 1920.

AMERICA'S SHIPPING OUTLOOK.—American shipowners, unwilling to pay the excessive prices demanded for government-built vessels by the Shipping Board, are placing contracts in well-established private yards for a promising amount of new tonnage of a well-designed and efficient character. These new contracts reflect the sober confidence of experienced men that there is a prosperous future for the American merchant marine in overseas trade, for which the ships that are being ordered are adapted. While some controversy rages in the public press over the question of the permanency of the sea-carrying industry which the great war has suddenly created, shipowners who are in a position to know most about it and have most at stake are quietly preparing to expand their fleets and broaden their activities.

They are doing this without any definite guarantee of particular aid and encouragement from their own Government. What Congress may do in the matter of an overhauling of our maritime laws and the enactment of new and better legislation is yet far from being determined. Beyond the fact that Senate and House, like the country at large, are overwhelmingly opposed to a long continuance of government ownership and operation of a merchant marine, nothing has yet been entirely developed in Washington. The reason for the confidence that is inspiring some of the soundest and most capably managed American shipping companies to acquire important new steamers is to be found not in any friendly governmental action of which there is thus far no positive pledge, but rather in certain new economic conditions of the utmost significance.

Operating and Construction Costs Nearly the Same.—Whatever may be the cause of the fact, the fact itself is indisputable that both in the cost of construction and in the cost of operation of seagoing steam tonnage, America, Britain and North Europe are now closer together than they have ever been before. When high-class, oil-burning cargo steamers of the unusual speed of 13½ knots and of 10,000 tons deadweight capacity can be contracted for in experienced and responsible American ship yards for a price of approximately $180 a ton, American overseas shipping of this character holds an undoubted attraction for conservative investors.

This is not to say that similar ships may not be available in Europe at a somewhat lower price, but the difference could not be a very great one,

and it is to be remembered that where ship prices in this country and abroad are approximately equal, the American-built ship has an undeniable advantage over the European-built ship in that the former can lawfully be used in the long-voyage coastwise trade of the United States, including the trade with Hawaii and Porto Rico, while the latter cannot be. It may be probable that the American-built ship will never actually be so employed, for our principal coastwise trades are admirably served by ships skilfully designed and adapted for them. But the possibility of coastwise chartering for the ship built in an American yard is a recognized factor of superior value which has won and will continue to win preference for native-built tonnage when relative prices here and abroad come into anything like the present close comparison.

If before 1914 any man had ventured to predict that within five years the monthly wages of seamen and firemen on British merchant ships, and what is more on Scandinavian ships—greatly increased in both cases—would come within three or four dollars of the wages of seamen and firemen on American ships, solicitous friends of such a prophet would straightway be considering an investigation of his sanity. Yet, in the North Atlantic this fact had become substantially true before July 28 last, when, on the demand of the crews, $10 and $15 a month were superimposed on the high American wage scale. Whether British and Scandinavian sea pay will follow this latest advance up to the existing American rule of $85 a month for seamen and $90 a month for firemen has not yet been demonstrated in any convicing way, but there is some present expectation of such a phenomenon.

Question of Ways.—However, the future prosperity of American overseas shipping does not hang upon such a slight matter as a few dollars a month difference in the wage-cost of the deck and fireroom. That difference was a formidable obstacle when we had a few deep-water ships under the American flag. It does not begin to count for its former weight now that we have a thousand ships and the will to use them. The entire cost of the working crew is a small percentage—varying with the type and tonnage of the ships—of the total cost of operation. Salaries of officers on British steamers in the North Atlantic trade are approximating the American rate instead of being a little more than one-half of it. Sea stores of all kinds, of course, habitually cost little if any more in this country than abroad—and in cases where they do cost more they can lawfully be imported for ships' use free of duty. Coal and oil fuel—a considerable item of ship expenditure—are now and probably for all time much cheaper in the United States than in Europe, and while this fuel difference may not count heavily on the regular Transatlantic routes it is a large factor in favor of American ships plying from our ports to South America, for example, against ships plying regularly out to South America from Europe.

So wide and momentous are these changed maritime conditions that only the other day one of the most prominent of British shipowners, a gentleman of world-wide observation, was moved to say on arriving in New York:

"Everything is greatly enhanced in price. Our repair bills are three times the ordinary pre-war costs. In fact, I think it costs as much now, if not more, to operate a British ship as an American ship. We are now paying nearly 50 shillings a ton for coal, Cardiff price, while in America it can be bought for from $5 to $6 a ton, or about half what it is costing us in England."—*The Nautical Gazette*, Dec. 27, 1919.

ENGINEERING

U. S. RAPIDLY USING UP ITS OIL RESOURCES.—In a paper to be read at the February meeting of the American Institute of Mining and Metallurgical Engineers, George Otis Smith, Director of the United States

Geological Survey, dwells on the importance of taking action at this time to secure an adequate oil supply for the United States. He will say in part as follows:

"The position of the United States in regard to oil can best be characterized as precarious. Using more than one-third of a billion barrels a year, we are drawing not only from the underground pools, but also from storage, and both of these supplies are limited. Last year the contribution direct from our wells was 356,000,000 barrels, or more than one-twentieth of the amount estimated by the survey geologists as the content of our underground reserve; we also drew from storage 24,000,000 barrels, or nearly one-fifth of what remains above ground. And even though the United States may to-day be the largest oil producer and though it consumes nearly 75 per cent of the world's output of oil, it is not a minute too early to take counsel with ourselves and call the attention of the American geologists, engineers, capitalists, and legislators to the need of an oil supply for the future.

"A most serious aspect of our oil problem presents itself when we consider the entry of the United States as a real factor in the shipping of the world—when we picture the return of the American flag to the seven seas. Any nation which to-day aspires to a large part in world commerce imposes upon itself an oil problem, for the future freedom of both the sea and the air will be defined in terms of oil supply. The new demand of our shipping program alone involves fuel oil in quantities equivalent to nearly one-half of the present domestic output, and, unless there is some corresponding decrease in other demands, this new requirement must be met with an increase in production of crude oil of nearly 200,000,000 barrels. How can such quantities of oil be supplied? Mr. Requa's earlier estimate of 52,000,000 barrels as the annual gain in output needed to meet the ordinary increase in consumption and to offset the expected decline in old wells would involve a task laid upon our oil companies, in their exploration and development activity, of bringing in a million-barrel new production each week. How can the oil fields of the United States maintain such a curve of new production?"

He concludes by recommending that American capital be encouraged to assist in the development of foreign oil fields, thus assuring the additional supply of oil required to cover our needs for a long time to come.—*The Nautical Gazette*, Jan. 24, 1920.

ELECTRICALLY-DRIVEN SHIPS.—The primary reason for electric drives was that turbo-generators running at high speed could be conveniently used to drive low-speed motors turning the propeller shaft, with high efficiencies of the driving power and of the driven propeller. This claim is now discounted by the use of mechanical gearing which gives a cheaper mode of speed reduction.

In the case of war ships the American naval authorities have been influenced in favor of electric driving by the facilities this offers to arrange that vital parts shall be out of harms way, and the length of propeller shafts reduced. Astern turbines are not needed, reversing being effected at the electrical connections. The electrical system as used on American battleships is now standardized. Some account of this is given.

In the *Tennessee* two turbo-generators run at speeds which may be from 1500 to 2250 r. p. m. These deliver power to three electric motors, the stator winding being arranged so that the number of poles can be varied, with corresponding differences of speed. The combination gives a variation in ships' speed of from 9 to 24 knots. In those vessels furnished with Ljungström turbo-generators, power is delivered first to two electric high-speed motors, driving the propeller shaft through reduction gearing of about 9 to 1. There is control of current to the motors by means of liquid resistance, for maneuvering purposes.

The electric drive has also been used in connection with Diesel engines, at first with no great success, but is now adopted in the United States for trawlers.—*The Technical Review*, Feb. 3, 1920.

VANADIUM IN STEEL.—In a paper read before the American Society for Testing Materials, Mr. G. L. Norris discussed the effect of vanadium upon steel alloys, and stated that until vanadium is present to the extent of 1 per cent, the physical and mechanical properties of steel increase as the percentage of vanadium is increased, but when 1 per cent is exceeded and with 3 per cent or more of vanadium, the steel is actually softened on quenching until unusually high temperatures are reached. As much as 3½ per cent of vanadium has been successfully used in high speed steels and 1.5 to 2.5 per cent is not uncommon. The improvement in high speed steel through the use of vanadium bears an almost direct relation to the percentage of the element present.

In the case of carbon-vanadium steel, the use of vanadium has proven almost equally beneficial. Such steel hardens deeper, retains its cutting edge much better, and is both tougher and stronger than steel without it. For comparison, it may be stated that a bar of 1 per cent carbon tool steel containing one quarter of one per cent of vanadium, quenched and drawn back at 400° C., may be bent ninety degrees without failure, whereas a similar bar without vanadium will fail when bent through twenty to thirty degrees. Compression tests on 1¼-inch cubes gave 470,000 pounds for the vanadium alloy and 278,000 pounds for steel without that element.

Vanadium steel therefore appears to combine hardness, strength, and toughness, which makes it admirable for pneumatic tools, rock drillers, and the like. The greater ease of machining vanadium steel as compared with carbon steels has made them particularly useful in the construction of automobile parts, where labor constitutes a large item and some parts can be made of vanadium steel at less than one-half the cost of the same part from high carbon steel.—*Scientific American*, Feb. 7, 1920.

SOME FACTS AND FIGURES ON THE HEAT TREATMENT OF HIGH AND LOW CARBON STEEL.—In the following considerations given to the subject of the heat treatment of low and high carbon steel, it is the aim of the writer to treat the subject from the view-point of practical shop operations, and to eliminate theoretical discussion as far as possible. It should be noted, therefore, that no attempt will be made to treat the subject in an exhaustive manner.

It is also assumed that furnaces used for the heat treatment of steel are of the proper design and construction, and that in order to produce the best heating conditions with reference to the character of the furnace atmosphere and control of the temperature, only such fuels are to be used that will give the right results for the class of work in hands.

The right results in any heating operation can only be obtained by means of a positive and accurate control of the combustible mixture. Fuels other than gas do not as a rule permit of the close regulation and control of the air-gas mixture that is necessary to control these results.

The human element plays an important rôle in all heat treating processes. Not only is it important to be well acquainted with the chemical composition of steel, the generation and application of heat, but it is also very essential to know the effect of different temperatures, furnace conditions, and methods of cooling upon the constituents of the steel. Absence of such knowledge often results in placing the blame on the steel or the furnace if proper results are not obtained. It is due to this same human element or skill in metal treating that one manufacturer is able to produce a far superior grade of article than his competitor at no greater cost. For this reason he may be justified in guarding such so-called "tricks" with great secrecy.

The skillful application of engineering principles to the design of modern machinery in the last decade has not only brought out the necessity for correct applications in heat treating methods, but has witnessed also the development of special alloys of steel, for particular mechanical purposes. Moreover, the results obtained in heat treating these steels have demonstrated the necessity for greater precision in temperature measurement; consequently the old method of judging temperatures by varying sades of color has given way to more exact pyrometer determinations.

Composition of Steels.—Steel is an alloy, a chemical compound of iron and carbon united in varying proportions according to the grade of the steel. It contains about 1 per cent of impurities in the form of manganese, phosphorous, sulphur and silicon. The carbon content varies from about 0.04 of 1 per cent to 2 per cent; the remainder is iron. In addition to the iron, carbon and impurities, some steels contain chromium, tungsten and vanadium, which are added to produce certain results.

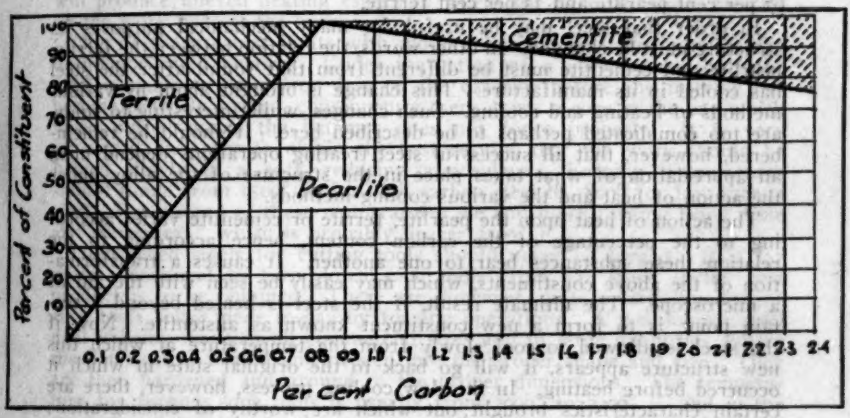

CHART SHOWING RELATION OF PERCENTAGES OF THE THREE COMPONENTS OF STEEL.

Carbon steel is divided into two general classes—low carbon or machinery steel, and high carbon or tool steel. Low carbon steel is soft, ductile and does not harden readily; on the other hand high carbon steel is harder, less ductile and has remarkable hardening power. The strength and utility of steel varies according to the per cent of carbon it contains. The following classification of usage represents good average practice:

Machinery steel contains from 0.04 to 0.15 per cent carbon.

Boiler plate and rivet steel has from 0.15 to 0.38 per cent carbon.

Tires, axles, rails, pistons, from 0.38 to 0.62 per cent carbon.

Cutting tools for soft materials and files from 0.62 to 0.88 per cent carbon.

Heavy cutting tools, bits, chisels and mandrels from 0.88 to 1.5 per cent carbon.

As has previously been stated all steels are an alloy of iron and carbon, the chemical combination of which is of great importance in the study of subsequent heat treating processes. The amount of the carbon content has a very pronounced influence upon the structure of the steel, which when placed under the microscope presents a granular appearance. Dur-

ing the cooling process in the manufacture of steel, the carbon content always combines with a definite amount of the iron, to form what is chemically known as carbide of iron. This combination presents a structure or grain of the metal very noticeable under the microscope and is known as cementite. The remainder of the iron free from carbon is called ferrite. Then again the cementite will form a mechanical mixture with the ferrite, in which the ferrite and cementite will appear in alternate stratas or layers and this is termed pearlite. The relation between these three compounds is such that all steels, very low in carbon, are made up almost entirely of ferrite or iron, with a very small per cent of pearlite. As the carbon content is increased the pearlite increases with a corresponding decrease in ferrite, until the steel has reached 0.85 per cent carbon, when ferrite will disappear and it will be entirely pearlite. After this point, cementite will appear, and a further increase in carbon will cause an increase in cementite with a corresponding decrease in pearlite. This relation is clearly indicated by the diagram. Thus it will be noted that a steel containing 0.6 per cent carbon will be made up of about 67 per cent pearlite and 33 per cent ferrite.

In order that steel may be useful for many mechanical purposes its structure must be changed. In other words, the relation between the ferrite, pearlite and cementite must be different from that found after the steel has cooled in its manufacture. This change is brought about by various methods of heating and cooling. Such changes, while interesting to study, are too complicated perhaps to be described here. It should be remembered, however, that all successful steel treating operations depend upon an appreciation of what takes place in the structure of the alloy under the action of heat and the various cooling methods.

The action of heat upon the pearlite, ferrite or cementite varies according to the percentage of the carbon content, hence according to the relation these substances bear to one another. It causes a transformation of the above constituents, which may easily be seen with the aid of a microscope. The ultimate result, if the steel is heated beyond a certain point, is to form a new constituent known as austentite. Now if the steel is allowed to cool slowly from the temperature at which this new structure appears, it will go back to the original state in which it occurred before heating. In the slow cooling process, however, there are certain characteristics brought out which are worthy of consideration; the transition taking place after the austentite stage is passed, is in the following order: Martensite, Troostite, Osmondite, and Sorbite, each stage denoting a correspondingly softer state of the alloy. This may be likened somewhat to the behavior of water when made to freeze into ice and then melted back into water, the constituents in this case, however, remain the same but appear in a different form, while with the constituents of the steel there is a constant change taking place while the steel is undergoing a change in temperature.

One of the most important points to be given careful attention in all heat treating operations, is that of the "critical range" of the steel, known as the "upper" and "lower" critical range. These values are not constant but vary according to the carbon content in the steel. The lower the percentage of carbon the greater the difference between these ranges. As the carbon content increases these two ranges approach one another until at 0.85 per cent carbon they merge into one.

The significance of this characteristic in the steel is that during the period of heating between the lower and upper critical range a transformation is rapidly taking place in the constituents of the steel, which begins at the lower critical range, and is completed at the upper critical range. In steel containing 0.85 per cent carbon, this transformation takes place immediately, while for precentages above this amount the transformation is slow.

It is important, therefore, to understand this characteristic of steel if the best success is to be obtained in all heat treating work. For complete annealing and hardening it is necessary to know the upper critical ranges in order not to exceed that point. Heating and cooling below this limiting temperature will not give full and complete results and exceeding it more than 50° F. will likewise produce inferior work, by increasing the granular structure of the steel and thus causing brittleness.

Forging.—There is probably no heat treating operation in use in which the principles of correct heat application are more abused than that of forging. Here again one would conclude from observing the majority of forging fires in operation that speed and not quality is the aim of the manufacturer. In the majority of forging work to-day, the steel is heated in oil-fired furnaces, the coal and coke fire having been abandoned on account of their slowness and irregular heating of the metal. A large number of forging furnaces are "makeshift" affairs constructed by a mason with an oil burner applied at one or both ends with little or no thought for economy or quality of the finished product. Such furnaces will produce uneven heating especially where the flame impinges directly on the work nearest the burner.

One of the greatest faults with modern forging work is found in the desire for rapid heating. Under the action of a very intense heat the steel is made to "run" or drip on the exterior before the interior has become properly soaked, consequently there exists a core in the bar which when placed under the hammer does not forge properly. It is very important, in order to obtain the best results, that the work should be heated slowly in a soft, reducing atmosphere. Forging temperatures should range from 1500° F. for high carbon steel to 1800° for low carbon steel. But instead of these temperatures we find more forging being done at "white heat" which is probably nearer 2500° F.

High speed steels for cutting tools should never be forged. It is far more economical to turn down such tools from bar stock if the best product is to be obtained. There are, however, quite a large number of such tools being made to-day by forging operations. A well-known steel drill is being made in all commercial sizes and in large quantities, where the flat stock is heated and twisted into the proper shape and size. They are then hardened and ground to the proper dimensions. The temperature for forging such tools is usually from 2000° to 2200° F. and in the product just referred to there is very little hammering done to the steel.

After forging, all steels having cutting edges or bearing surfaces should be reheated to a temperature of from 1400° to 1500° F. and allowed to cool slowly. After this operation they must be ground in order to remove a thin coating of decarburized iron existing in all hot rolled steel, otherwise if this surface is allowed to remain, it will prevent hardening.

Until recently the utilization of gas for forging has been considered too expensive in comparison with coal, coke and oil due principally to the lack of efficient gas-heated furnaces.

A highly satisfactory and efficient gas-heated forge is now obtainable and a number are in actual operation. The furnace is much easier to operate than those heated with other fuels, and requires practically no attention after the desired working conditions are obtained. The burners are supplied by an air-gas automatic proportioning device, which gives a homogeneous mixture, and they can be adjusted to give a slightly reducing furnace atmosphere in order to minimize the formation of scale.

A furnace of the above type was installed recently in the plant of a Philadelphia manufacturer, and after making comparisons between it and a coal-fired furnace, the following results were obtained:

	Coal-fired furnace	Gas-fired furnace
Number of pieces handled per 9-hr. day....	1,400	2,122
Overall efficiency	6.84%	25.23%

The increased production and superior operating advantages were sufficient to offset a slightly higher fuel cost.

The great advance in the shipbuilding industry during the war gave rise to many innovations. One of the outstanding features of this development was the substitution of gas for fuel, replacing fuel oil in a number of forging operations. Four or five yards adopted it on an extensive scale, and two yards used it exclusively, except for a small amount of coke used in portable rivet heaters.—*Scientific American*, Feb. 7, 1920.

AERONAUTICS

RADIO MESSAGE FROM AN AEROPLANE SENT 175 MILES.—Recently during the regular maneuvers of the 37th Infantry at Fort Mackintosh, wireless signals sent from an aeroplane were recorded on the receivers of the U. S. Intelligence Station at Del Rio, Texas, a distance of 175 miles. An altitude of 300 feet was maintained during most of the time and a general north and south course was flown. Several messages which were coded and repeated were received without a break although the operator listed in his report that they became faint at times and the distinctness varied which was likely due to the direction of the flight.

This is perhaps the greatest distance that messages have been received and will probably go down as a new record. A wave length of 550 meters was used.—*Aerial Age Weekly*.

AVIATION IN SOUTH AMERICA.—Proposals to the Chilian Government for the establishment of an aeroplane factory in Chili, by an English firm, and the organization of a postal service between the principal cities are meeting favorable reception at the hands of government officials.

A detailed report on the project has been forwarded to the Government Finance Minister by Gen. Don Pedro Dartnell, following careful study of the plans as outlined by the John Thomas Aircraft Manufacturing Company. In his report the General gives detailed economic, commercial and military reasons for favoring the undertaking.

"The introduction of this new branch of enterprise into Chili would undoubtedly stimulate a number of the national industries," comments the paper, "and at the same time find employment of a skilled kind for many hands, while it would also mean the introduction of not less than $2,500,000 capital.

"The military air service would benefit by being made independent of material imported from abroad, with the establishment of an efficient postal service throughout the country population."

Well-organized steps to incorporate aviation in the development of their resources are now being taken by eight of the South American republics. Flying is being extensively employed for military and naval purposes, and it is expected that aviation to carry passengers to outlying mines and ranches will soon be developed on a large scale, as at present transportation by rail, water and pack animals is extremely slow and difficult.

According to a foreign aeroplane representative, Brazil has done more than any other South American country toward the development of aviation. Plans are now under way for the establishment of several mail routes and for transportation up and down the Brazilian coast some 1000 miles, while several planes have been sold for private use.

In Uruguay and Argentina Government air schools have already been established for both naval and military pupils, while along commercial lines the former all-night trip by steamer from Montevideo to Buenos Ayres has been reduced to an hour and a half by the use of the aeroplane.

Bolivia is rapidly undertaking the use of aeroplanes, an American ace having recently been employed by the government to set up a flying school. Machines are also being sent to Venezuela and to Colombia, where they will engage in military and passenger work.

In Peru, however, aeroplane representatives say they have found more enthusiasm for flying than in any other South American country. Already several Peruvians have qualified as pilots, and more machines are expected to be ordered at an early date. It is expected that in Peru the many difficulties of transportation, due to the mountainous contour of the country, will be overcome through the use of the plane.—*Aerial Age Weekly*, Feb. 16, 1920.

THE AIR POLICY OF THE UNITED STATES.—(A British viewpoint.)—So much home criticism has been from time to time focussed upon the air policy of the British Government that it may not be amiss to take the opportunity, when it occurs, of turning from the sincere, but not always favorable, opinions expressed by experts and others amongst our public men to those formed by experts of other countries with regard to that policy and the way we have utilized our past experience and our recent opportunities, bearing in mind all the time the obvious need for retrenchment in our public expenditure at the present juncture. To view things in their right perspective we need to "see ourselves as others see us," and such an opportunity is afforded by the report of the American Aviation Mission, which, headed by the Assistant Secretary for War of the U. S. A., visited not only England, but France and Italy, during the summer of 1919, and consulted leading Ministers, naval and military and Air Force officers and other aeronautical experts in those countries.

The report, while making certain strong recommendations as to the future air policy of the United States, refers incidentally to the extraordinary similarity of the conclusions drawn from war experience in Allied countries and to the points which specially impressed the members of the Mission in regard to those conclusions and the policy resulting therefrom in each country.

Great Britain evidently considers the dominance of the air as important as that of the sea and is avowedly planning a definite policy of aerial development to that end. Owing to the co-ordination for more than two years of her aircraft activities she is well in the lead in practically every phase of aerial development. The Mission considers that while Great Britain's plan of organization is not perfect, it undoubtedly to-day stands as the most comprehensive government mechanism yet set up by any nation for the encouragement, upbuilding, direction and control of its air resources. It is the product of five bitter years of trial, mistake, experience and progress. It is also the product of the best brains in the British Empire, focussed under the spur of national need and the demand of the British people, and, the report goes on to say, "America may well study it carefully."

In England, France and Italy sentiment is undoubtedly in favor of the centralization of aircraft development under one authoritative head. Difference of opinion has been encountered only in the matter of army and navy personnel and in the question of the independent fighting force.

The Mission recommends the concentration of the air activities of the United States, military, naval and civilian, within the direction of a single government agency, created for the purpose, co-equal with the Departments of War, Navy and of Commerce, called, for purposes of identification, the National Air Service.

The United States Secretary for War, Mr. Newton Baker, in a memorandum on the report, says, however, that the Mission has, in his opinion, gone too far in suggesting a single centralized Air Service, albeit it is clear that the ingenuity and ability of American engineers and inventors must be co-ordinated and national effort freed from duplication. Army and navy aviators, he points out, are specialists in the art; both the machines and the pilots are of a different type from those required for civil undertakings. The pilots particularly need to be trained upon a different theory. The Joint Board of the army and navy of the United

States is already eliminating duplication and producing co-operation in developing the Air Services of those departments, and should Congress decide to extend its aid to the commercial development of aircraft co-operation will be easy in all matters of invention, design and production where the different aspects of the problem meet on common ground.—*The Army and Navy Gazette*, Jan. 10, 1920.

THE EFFECT OF AIR SERVICE ON THE TACTICS OF COAST DEFENCE.—A great many incidents and operations of the World War have pointed out the necessity of some radical changes in the methods and matériel needed for coast defence. Although no coast defence was successfully penetrated and held after actual attack from the sea during the war still the signs of the times should be noted and proper allowance made for things happening in the initial stages of war that happened in this war only after months and years of actual hostilities.

The principal attacks on coast defence stations occurred on the Belgian Coast, at the Dardanelles and on the shores of Russia. The attempts on Russian defences occurred in conjunction with wide sweeping land movements after Russia was practically out of the running. The British made sporadic attempts to threaten and annoy Heligoland and the coast of Germany. They succeeded in doing a great deal of damage to the shores at Ostend and even to shove a cruiser in during a smoke screen and darkness and sink it to close up a submarine base. This was all within a hundred miles of their own powerful naval base of Dover. It appears that terrestrial observers alone at Ostend could avoid most surprises although high flying German planes on clear days could relieve the monotony of the vigil. In fog, destroyer squadrons of both the Allies and the Germans were able to navigate rather freely in the North Sea. In other words the old adage that if you wanted a hostile fleet to quit harassing your coast you should go out with boats and fight it, remained true.

By the use of Zeppelins the Germans watched the British fleet in a manner that was remarkable. The British repeatedly sent out swift cruisers laden with airplanes and by launching the planes at sea succeeded in maintaining a careful watch of the German fleet. They were not very successful in watching the German fleets that operated off Libau, the Aland Islands and Kronstadt. The Italians with the use of semi-rigid airships and airplanes operating from the Italian mainland succeeded in keeping an accurate account of the Austrian fleet.

The submarine turned out to be an exception to the rule. Its whereabouts were hard to ascertain. The small airship of the British and German Zeppelins turned out to be the best submarine spotters. The submarine leaves a wake even when traveling under water and a mixture of foam and oil rises. It is the oil trail that is the worst telltale against the submarine. In warmer seas its phosphorescent trail at night is almost as bad. The airship can proceed slowly while the crew peruse at leisure with naked eyes and with the largest sizes of field glasses. The airship therefore will more and more become a part of the coast defences. It can far outclass the airplane as a watching device and a fire control station to direct fire against submarine cruisers that seek to surprise exposed cities like Lynn and Atlantic City.

The seaplane disappointed its advocates. But since it has a field of use of its own, *i. e.*, the use of water instead of land for landing and launching field, it undoubtedly will in the future be able to do reconnaissance work and submarine hunting where it is not liable to be attacked by airplanes. The seaplane can hardly contend with a good chasse plane. In coastal waters where dealing with the enemy who has little or no air service it can with impunity remain in lagoons, inland passages and lee shores while carrying out reconnaissance and bombing missions. The

shores of the Atlantic offer special opportunities for the use of the seaplane. On the Pacific the presence of mountains and the scarcity of decent landing places all along the shore make its use by an invading fleet almost necessary. It is rather improbable that an enemy would launch planes in great numbers from ships to send into the interior on a mission of bombing or with a view to establishing a base there. He would want to keep his aircraft where he could supply and overhaul them. This points to the need of seaplanes for the initial attack on any shore. Therefore seasonal storms will regulate the time of attack.

What will be the most probable form of attack in the early stages of a coastal war of the future? Navies still have very fast battle cruisers, plane-carrying craft, submarines, battleships with guns that can fire about 25 miles, large seaplanes and great fleets of destroyers, sub-chasers, etc., that can cross the ocean. They also have airships that can be folded up into bundles less than the fuselage of an airplane and can be inflated upon arrival at a destination and can be supplied and repaired on the deck of a steamer or battleship, or a submarine for that matter. In addition the upper heavens will see an accompanying fleet of rigid and semi-rigid airships. Helium producing gas wells are very common now and the lighter-than-aircraft of to-morrow is not a traveling charge of explosive. This non-burning gas will probably float most of the airships of the future.

So it will be seen that the sea fleet of to-morrow is not the blind thing it has been when the question of information on land is desired. Out of the dawn behind a cloud of smoke there may come the sound of great guns firing at an important harbor. Overhead will be the whir of aircraft. Now and then the terrific bursts of aerial bombs of great size exploding near the forts. Then flotillas of smaller craft will head for suitable landing places. Other squadrons of planes and fleets of airships will be dropping men, and munitions and food at vital points of communication to dynamite railroads. The value of the parachute for this purpose was conclusively proven during the war. We may expect to see whole hamlets along the shores captured and their inhabitants held as hostages against bombardment and required to help dig the bomb-proof shelters of advanced outposts near the beaches. Scenes like this may occur at scores of points along the shore. Our great coastal routes by land and sea will be broken up in a day. No matter how small each of these attacks is, each will be a diversion to others. It will be hard to fathom the main point of attack where transports with convoys will head for in the days or hours to follow.

It is easy enough to ask, "where will our navy or our air forces or our coast artillery or our cavalry, field artillery and infantry be? Could such activities and preparations escape discovery beforehand?" No man of the United States Army should forget the mobilization failures of the late war. They should not even forget the time it took to get 40,000 lightly armed men to the Mexican border after Villa's raid. Attacks like this cannot be met at many points along our coast simultaneously. We might have a navy victoriously clearing a part of the seas while another fleet of the main enemy, or the fleet of another member suddenly drawn into the coalition acting against us, avoids notice and, using a foggy ocean all too badly watched, effects a surprise such as was never seen in the days gone by.

All of our attacks need not come from the sea alone. A hostile Canada or a hostile Mexico or either of these, conquered by an alien enemy, might be the landing place of another form of attack. We may find it necessary to help these people to protect themselves against such a coastal attack by an enemy or coalition that had us in view for a later assault. At any rate the use of aircraft will be resorted to. Much worse for us if they get an inland foothold. Then they can flank our line of defence at the shore.

There has long been a favorite remark made by ultramobilist officers of our army about the ease with which we can defeat an enemy who is so foolish as to invade our contry. That was a rather wise saying before we had cities worth billions of dollars all in small areas, areas where a single bomb or a 12-inch shell could do $20,000,000 worth of damage in a second. Single buildings are the nerve centers of great industries. There were not railroads formerly that carried vast tonnages and whose interruption for even a day may dislocate the industries of great stretches of territory. We then did not have the locks of the Panama Canal, nor the Wellington Canal, nor the Erie Canal. We then did not have subways and the great river bridges of New York and other places. We then did not have harbors where valuable shipping laid closely moored against the docks or in basins.

The place for any nation having a seacoast to defend itself is at its beaches. Here he can cause the enemy to change from water tactics to land tactics in action. Here a few devoted men properly equipped can delay and even defeat powerful expeditions. The old artillery and engineers who built our first brick and stone forts were just as right as are the Coast Artillerymen and the Engineers of to-day. In land warfare the thin line of retarding forts is a vanity, the forts and their garrisons are both easily captured. Only to-day we are dealing with navies that are no longer blind. Navies are faster now, more elusive and no longer at the dictates of the weather. To-day a lee shore, a lagoon, a coastal passage, a sandspit, or an island out in the fog is a valuable asset, since an enemy can there assemble and dispatch their aircraft on any mission ranging from reconnaissance to transport of men and supplies. Witness the seizure of the Islands of Tenedos near the Dardanelles. According to Homer, the Greeks used it also during the horse trading episode. Attacks between harbors will be more frequent. Out of the way bases like the Bahamas or Albermarle Sound will be used to interrupt coastal rail and sea traffic and to menace great expanses of territory.

The question then is how to prevent these interharbor landings and the seizure of offshore bases, or if we cannot prevent them how soonest to drive them out. Coastal routes of defence both rail and highway are needed, also fast railroad and tractor artillery of all calibers, and anti-aircraft artillery both fixed and mobile.

At the strong points near the great harbors the heavy artillery can be emplaced for protection against ships' barrages and aerial bombardment. But since the war may shift it should be possible to transport these expensive pieces to the regions where needed after they have served their purpose of guarding the shore in the first stages of the war. In the early stages of the war it would be unfortunate indeed to have our heavy ordnance stored at some central point. Good intentions and mobilization orders cannot repair broken down bridges or dynamited tracks, neither can they lighten the burdens on routes of communication already overloaded by the traffic of war. All that an enterprising enemy need to do in the early stages of war is to damage the routes of shipment into the defences and there will be no cannon to oppose when his ships come in.

On account of the terrific barrages that will be delivered by fleets it is highly probable that the emplaced guns near the shore will receive some very rough treatment. The personnel must take to bomb proofs and guns will be lost. It will then appear easy to enter the harbor if the mines have been destroyed.

Here at the harbor defences it then becomes necessary to have a second and mobile line of heavy guns. Railroad mounts or supertractors will be needed. They can be camouflaged or emplaced with slight protection to cover the entrances or take the place of guns on the shore that are put out. They should be able to get away quickly if it gets too hot, or so as to get a better field of fire or shorter ranges to operate against ships that are extending the flanks of the action or that are getting into blind sectors.

It is foolish to have nothing but railroad mounts as railroads are very easy for bombers. They give away the gun anyhow. If they don't hit the gun they localize it until the track can be repaired. The tractor needs no road.

This use of heavy mobile mounts and constant shifting of position will run off into mobile methods of warfare and especially will it call for the use of aircraft for fire control and reconnaissance. It will be necessary to have near every important harbor an air service establishment where various types of aircraft are kept ready at all times for call. There should be reconnaissance planes, chasse planes, day bombers, airships and seaplanes. A properly equipped station should be able to patrol the coast 100 miles each way and to send out craft at least 200 miles at sea. This service in good weather will eliminate surprise even of submarine cruisers and will give the shore watchers a great deal of much-needed rest. It will tell when a blow is impending, not when it is struck.

In addition to airplanes and airships there should be localized balloon companies, to operate captive balloons and what were known as barrage balloons. The captive balloon is a very reliable observation station. Observers in it can command vast stretches of water. They will save many shore watchers and can help the shorter range guns in firing under 30,000 yards. For mine defence they will be excellent since they cannot only control the fire of minor caliber guns but also can be used to patrol for friendly and hostile mines. They were used for this while being towed by tugs, in the harbors of the british channel. They also helped to hunt down submarines in the harbors and shore waters before the small airship became efficient.

Barrage balloons were used at night to suspend wire entanglements over important objectives. In the daytime they were subject to attacks by airplanes so that it was impossible to maintain them. Essen was protected this way long before the allies used the same expedient for London and Paris. Wires at night have a great moral effect. They did not capture many planes during the war and were as hard on their friends as on their enemies but nevertheless they will in the future be used to protect coast defences against low bombing and reconnaissance.

Coast defence balloon companies will be invaluable in the landward firing of the coast defence armament and in perpetuating among heavy artillerymen the traditions of aerial liaison. A good balloon observer becomes the eyes of all, he keeps a foot on the ground as it were, and the artillerymen and infantry can always get information by telephone from the high heavens. The balloon observer always wants to get into a plane and go out to get a closer view of things. He is the connecting link between the air service and ground troops—a moral asset of no mean value.

Aircraft will make it possible for Coast Artillery to fire at great ranges. Targets can be below the horizon or behind smoke screens and fog. Fog is a great friend of the small airship. They are very vulnerable, but in a fog they cannot be seen, sometimes not even heard. An airship can raise and lower itself without the use of its engines. So for spying out a fleet that is using a fog or smoke to hide it, it is very efficient. They can stand by for hours, and, at night perform better than in the day time due to the constant temperature of the air. The airship will be excellent for patrolling friendly mine fields and for destroying hostile ones. Airships and airplanes can help supply the detached pickets of a coast guard. They will undoubtedly help to reduce the size of coast guards on land. Many young airmen are over-sanguine about the ability of an airforce to keep a navy under water, to sink battleships and to prevent surprise in any weather. They are also unaware of the fact that explosion for explosion, bomb for bomb, and pound for pound, it costs more to deliver the goods in the way of an air attack than it does by the nitrocellulose route. It costs a dollar a minute to fly a small reconnaissance airplane,

and no aircraft in the world can guarantee the percentage of hits that artillery can. Neither can aircraft guarantee that absolute infallibility that artillery and the shore watcher can. Snow, hard rain, hail, fog and darkness almost eliminate the airplane in shore defence. The physical limitations of pilots in cold weather also constitutes a terrible handicap. Airplanes and airships must constantly be renewed. They cannot be stored for years at a time like ordnance, and the maintenance of skilled pilots involves an enormous annual expense and a casualty list. The United States is a country where policies vary. There are financial panics. Some Congresses will be willing to do the right thing by the coast defences and will supply the funds for a really efficient air force, both for the mobile army and for a coast patrol. But we cannot predict what each session of Congress will bring forth. It is well to have on hand a properly distributed supply of artillery with strong points to store it in and guard it, and to insist that the artillery be supplied with proper aerial help and stations at proper intervals.

Since the need of a true shore defence with railroad and other mobile mounts is apparent, we are confronted with the question of supplying proper rail and other communications to get to the firing points along the beaches. What railroads shall we use? A glance at the maps will show that there are very few suitable railroad tracks that go within short cannon range of the shore much less affording facilities to fire far out to sea. The cost of railroad track is high. Ties and rails rot and rust away. How can this first cost and the maintenance charges be met without causing a great deal of indignation over the bill in Congress? The answer is rather simple in view of the fact that shore property is rapidly rising. With the return of the American to the seas there is a tendency to want to live near the ocean. Very soon there will be a hamlet at every little harbor or inlet. All of these will need railroads. Why not have the government build and subsidize these? Let the engineers prescribe the rail, curves, grades and clearances. Then turn them over after construction to operating companies. In the course of a few years they will be self-supporting and will do a great deal of good in opening up to intensive cultivation some of the most productive soil and the finest living areas in the country and inducing more people to live near the sea shore. Summer and winter resorts will grow up around these spurs and coastal routes, and very little will be heard from Congress about the matter of cost.

There are a great many wide coastal marshes on the Atlantic coast. Some of these are so wide that it will be impossible to shoot across them with the guns provided. Places like these are sure to be used by the enemy to establish blockading and harassing air bases. The cost of railroads to get cannon out far enough to bomb them will be prohibitive. If the navy is unable to dislodge them without undue risk or cost, there remains the expedient of the bombing plane. Our bombers working on short lines of flight from a base near some neighboring railroad can deliver so devastating a fire that the places will become untenable. There should be some attention given to this comparative cost of artillery communication and aerial transport for shore bombing. It will undoubtedly be found that there are extensive reaches of coast where the problem can best be turned over to the air service.

The artillery must deliver infallible service every day of the year in all latitudes near the great economic prizes of the shores. There are still a few places that can bide their time, but there should not be a mile of coast that cannot be effectively bombarded by the air force or the artillery if the defences of the coast are to be considered complete.

The question naturally arises as to where and when and at what cost we shall start on this policy of modernizing the coast defences. No one should overlook the matériel and stations developed during the war or the personnel who were trained in both the air service and the artillery. Either by accident or intention there were built in the immediate vicinity

of Fort Monroe, and very conveniently connected with it by water, railroad and highway, an airplane station, a seaplane station, an airship (dirigible) station, a balloon school and a heavy artillery cantonment. It takes about ten minutes for a plane to fly over from Langley Field, an airship can make it in half an hour and eight balloons can get up ready for observation on proper notice or can merely be told that shooting will start immediately in case there is a class in the air. At Camp Eustis railroad and tractor mounts can be used. If the air observers wish to train over the water, then river firings at Camp Eustis with mobile mounts, or ocean firings at Forts Monroe and Story can be quickly arranged for. Balloons can be ferried to Forts Monroe and Story. The railroad and tractor guns from Camp Eustis form a second and mobile line of defence for the defences of the Chesapeake. These guns can also be sent to innumerable points along the coast, being stored and used for school purposes at Camp Eustis. A regiment at a time can be sent to Camp Eustis to be trained for coöperation with the air service in the new tactics of coast defence. The air service can reciprocate by sending airmen or even whole squadrons to Langley Field for the same purpose.

In other words there has been salvaged from the war and the past a set of air and artillery stations and equipment where artillery-air service liaison can be perfected at little new cost. Here observers can be given opportunities to see real guns of all calibers, on fixed and mobile mounts, firing real charges at fixed and moving targets on both land and sea and to see real shell of all calibers bursting on land and water.

These facilities cost a considerable amount because most of them were built during the war. Langley Field cost ten million dollars, the Lee Hall Balloon School cost two million dollars, the airship station at Langley Field when finished will be worth one and one-half million dollars, Camp Eustis cost fifteen million dollars. But since they are so conveniently placed and form the real modernized defence of one of the greatest of our harbors where there is vast shipping and many naval activities to watch, and since all of them are finished and going concerns, why should we not immediately start a new policy with a view to accumulating policies and getting cost data for use in developing the defences of other harbors and the coastal regions between.

The writer admits that there is pretty much of a quandary about the future of coast defence as a result of the lessons of the war. But the outstanding facts are, that navies are no longer blind, navies are capable of quicker mobilizations than ever before, that navies as a result of their great speed and aerial assistance are fully as capable of delivering surprises in foggy seas as heretofore, that bombardments at unprecedented ranges are possible and that every mile of shore should be defended by artillery and air service combinations.—*Journal of the United States Artillery*, February, 1920.

MISCELLANEOUS

THE MEANING OF F.O.B.—Until a uniform interpretation of the expression F.O.B. is established, the American Chamber in London, says *The Bulletin of the Federation of British Industries*, publishes the parallel meanings prevalent in each country. If buyers and sellers on both sides of the water will study them, or keep them handy for reference, they will always know not only what a quotation from the other country may mean, but also how their own quotations may be interpreted there. When a British merchant quotes "f.o.b." the accepted definition is: Free on board export vessel, with further charges only to the buyer, the mate's receipt, wharfinger's receipt, or dock receipt issued against the goods being immediately exchangeable for the bills of lading. "F.o.b. port" (New York, Boston, etc.) is upheld both by law and by good practice in the United States to mean the same thing as in Great Britain. It has been found,

however, that American shippers, with the best intention, have often misconstrued this as if equivalent to "delivered railway station—port," sometimes leaving to the foreign buyer not only the charges, but even the actual arrangements for the transfer of the goods from the railway station to the vessel. The only infallible remedy is for American sellers to make, and for foreign buyers to insist upon, quotations "f.o.b. export vessel." There is then no opportunity for misunderstandings. "F.o.r." meaning "free on rails" is the term used by British merchants for domestic inland traffic, and corresponds to the American "f.o.b." "F.o.b.," as previously stated, is used extensively in the United States for domestic inland traffic, meaning "free on board railway car at point of origin." The gravity of the present situation is indicated by the National Foreign Trade Council's recent statement strongly urging American exporters and manufacturers to standardize the interpretation of "f.o.b. port" as meaning "f.o.b. export vessel." The *Foreign Trade Bulletin* of the American Express Company, issued at New York in October, discusses the question with unmistakable finality.—*Engineering*, Jan. 30, 1920.

WHAT TONNAGE MEANS.—The term "tonnage" in the shipping business has five meanings, according as it refers to deadweight, cargo, gross, net or displacement tonnage. Deadweight tonnage is the difference between the number of tons (of 2240 pounds) of water a vessel displaces "light" and the number of tons it displaces when submerged to the "load water line."

Cargo tonnage refers to either "weight" or "measurement." The weight ton in the United States and Great Britain is the English long ton of 2240 pounds. A measurement ton represents 40 cubic feet of space.

Gross tonnage refers to vessels and not to cargo. It is found by dividing the capacity of the vessels' closed-in spaces in cubic feet by 100. A vessel ton is 100 cubic feet.

Net tonnage is a vessel's gross tonnage less the space occupied by crew, engine room, bunkers, etc. In other words, it is the space available for passengers and cargo.

The displacement of a vessel is the absolute weight in long tons of the vessel and its contents. Its light displacement is its weight without stores, coal or cargo. Its loaded displacement is the weight of the vessel with cargo, fuel and stores.

The Shipping Board, upon whose definitions the above has been written, gives the following relative tonnage figures for a modern freight steamer: If a vessel has a net tonnage of 4000, its gross tonnage will be 6000, its deadweight carrying capacity, 10,000, and its loaded displacement, 13,350 tons.—*Scientific American*, Feb. 28, 1920.

HELIGOLAND FORTRESS BEING DISMANTLED.—Heligoland, which until two years ago was Germany's practically impregnable fortress, the defensive strength of which was so great that the Allies decided that it was useless to attack it, is now so far dismantled as to be of no military value, according to a press dispatch from Berlin. The work of dismantling has been going on for more than one year, but German army engineers who constructed the fortress declare that it cannot be completely "demobilized" in less than seven years. All the guns have been dismounted, but the gun emplacements remain as well as the harbor works and part of the fortifications. The stronghold was built at a cost of $175,000,000, but its guns were fired only once during the World War, which was when the British warship *Shannon* was the target. Every part of the defences was worked by hydraulic power. The water necessary for the defence of the fortress and for sanitary purposes was drawn by huge pumps from fifty feet below sea level. While the Germans believed the secret of the plan of fortifications was unknown to others than their government, it is now said that a British naval officer, who posed as an American naval officer, visited all the fortifications in 1913.—*Army and Navy Journal*, Mar. 6, 1920.

THE DISARMING OF GERMANY.—If the French consider the disarming of Germany a life or death question, and the strict enforcement of the other clauses of the Treaty of Versailles as essential to the continued existence of France as a first-class Power, the Germans have only themselves to thank. The taunt frequently expressed by German prisoners of war and by German troops evacuating Belgium and Alsace-Lorraine, "You will see us back again in another five years," might, perhaps, be passed over as bravado, but the opinions of such an important Minister as Herr Erzberger cannot be thus treated. Whatever he may say now, his letter of April, 1919, extracts from which were published in the *Times* of January 17 of this year, betrayed no spirit of peace or of repentance. Another war, he said, between Germany and the Anglo-Saxons is inevitable. France is "their strongest outpost on the Continent; but she has been so thoroughly weakened she will never be able to recover." "Her position on the Continent is in the long run untenable." If Germany can undertake the restoration of Russia (this and similar German statements furnish a strong argument, it must be confessed, against trusting in German help against Bolshevism), "she will be ready in ten or fifteen years to bring France, without difficulty, into her power. The march to Paris will be easier then than in 1914." The Poles, on Germany's Eastern frontier, have the same fears—lately expressed to a Paris correspondent by General Dorbor-Musnicki, commanding at Posen—as have the French in the West. To disarm her now that it is possible is the natural desire of both nations.—*The Army and Navy Gazette*, Feb. 14, 1920.

WRECK-PROOF SAFE FOR OCEAN-GOING MAIL.—The Dutch Postal Service has recently put into use, on the mail steamers of the Netherlands Steamship Company, carrying the mails to and from the East Indies and other parts of the world, a very ingenious invention known as a floating safe, which as a protection of valuable mail during the perils of transit at sea is very likely to prove of most vital importance to commerce.

At the best shipwreck leads to the loss at sea of valuable mail containing drafts, checks, money orders, stocks, and bonds and thus results in serious delay in straightening out and settling affairs in relation to the same. The constant danger of such accidents has undoubtedly had a retarding influence on international commerce along certain lines, besides demanding high insurance rates and much duplication, as a matter of protection, of valuable papers before the originals were entrusted to the steamer mails.

Everything taken into consideration it is rather remarkable that no serious attempt to safeguard more thoroughly the mails in case of shipwreck has been made by the nations of the world long before this date. But the fact remains that the Dutch Postal Service is a pioneer in this very important direction.

The floating safe which the Netherland Postal Service is now using so successfully, is quite different in appearance from the ordinary safes with which we are familiar in banks, offices and stores. Instead of being square like the average safe, it is oval in shape, painted a glistening white, and with the word "Safe" painted upon either side in big black letters, which stand out and can be seen at a considerable distance.—*Scientific American*, Mar. 6, 1920.

DEATH OF PEARY.—Rear Admiral Robert E. Peary, discoverer of the north pole, died in Washington on February 20 of pernicious anemia. He was 64 years old, and the greater part of his active life had been devoted to polar exploration. The explorer was 52 years old when, in July, 1908, he set out on his eighth and successful invasion of the polar region. Captain Bartlett, the veteran navigator for Peary, shouted to Colonel Roosevelt as the ship was leaving its wharf here:

"It's the pole or bust this time, Mr. President!"

The method of attacking the pole was in five different detachments, pushing north in the manner of a telescope and planned with the precision of a military campaign. At the 88th parallel Peary parted with Captain Bartlett, in charge of the fourth detachment, and he, with another member of his crew and four Eskimos, made the final dash. They covered 135 miles in five days.

"At this time," he said in his book, *The North Pole*, "it may be appropriate to say a word regarding my reasons for selecting Henson [Matthew A. Henson, an assistant] as my fellow treveler to the pole itself. In this selection I acted exactly as I have done on all my expeditions for the last 15 years. He had in those years always been with me at my point furthest north. Moreover, Henson was the best man I had with me for this kind of work, with the exeception of the Eskimos, who, with their racial inheritance of ice technic and their ability to handle sledges and dogs, were more necessary to me as members of my own individual party than any white man could have been. Of course, they could not lead, but they could follow and drive dogs better than any white man.

"Henson, with his years of arctic experience, was almost as skillful at this work as an Eskimo. He could handle dogs and sledges. He was a part of the traveling machine. Had I taken any other member of the expedition he would have been a passenger, necessitating the carrying of extra rations and other impedimenta. It would have amounted to an additional load on the sledges, while the taking of Henson was in the interest of economy of weight."

He then went on to describe the march that began on a clear, sunlit morning, with a temperature of minus 25°, with the wind of the last few days, subsided to a thin breeze. With each passing dav, he said, the Eskimos were becoming eager and interested, notwithstanding the fatigue of the long marches. They would climb to some pinnacle of ice and strain their eyes to the north, wondering if the pole was in sight, for they were certain that the party should get there this time.

Peary's last march northward ended at 10 o'clock on the forenoon of April 6. After the usual arrangements for going into camp he made the final observation, indicating that his position was then 89° and 57 minutes.

"Yet, with the pole actually in sight, I was too weary to take the last few steps. The accumulated weariness of all those days and nights of forced marches and insufficient sleep, constant peril and anxiety, seemed to roll across me all at once. I was actually too exhausted to realize at the moment that my life's purpose had been achieved. But, weary as I was, I could not sleep long. It was, therefore, only a few hours later when I awoke. The first thing I did after awaking was to write these words in my diary:

"'The pole at last. The prize of three centuries. My dream and goal for 20 years. Mine at last! I cannot bring myself to realize it. It seems all so simple and commonplace.'"

Observations, which were later registered at the United States Coast and Geodetic Survey in Washington, were made and the return trip made in all haste. Though conscious that he was leaving, said Peary, he did not wait for any lingering farewell to his life's goal, as 413 nautical miles of ice floes and possibly open leads still lay between the party and the north coast of Grant Land.

"I gave one backward glance and then turned my face south and toward the future," he said.

He had spent 30 hours, from April 6 to April 7, around the pole, a great tract of frozen sea—none of the land which Dr. Cook reported. The weather was cloudless and flawless. The temperature ranged from 33 below to 12 below. Where open places permitted soundings 9000 feet of wire, which was all Peary had, failed to touch the bottom.

When he got back to civilization Peary was surprised to find such a fierce controversy raging over him and his rival, Dr. Cook, but he easily established his claim before scientific bodies throughout the United States. He was raised to the rank of Rear Admiral of the United States Navy and retired on pay. Congress voted him its thanks in a special act and gold medals, decorations, and honors of many kinds were showered upon him.—*Mid-Week Pictorial*, Mar. 4, 1920.

FRIGHTFULNESS "UNDER ORDERS."—The question of how far the men of the German Navy and Army can be held responsible for the atrocities alleged to have been committed "under orders" is likely to crop up several times during the investigations into the inhuman acts which marked the conduct of the campaign by our late enemies. Two Germans concerned in destroying factories in the invaded area have, it is reported, been tried and convicted, and Berlin has protested that these men cannot be held responsible, as they acted "under orders." It is doubtless true that if such a plea was admitted, the vilest crimes against humanity might be committed under the cloak of war with impunity. It is equally true that there must have been numerous occasions in the late war when frightfulness was deliberately ordered by the higher command, so that to punish only the men who had to carry it out would be unjust. To fix the responsibility is not easy, but should be possible all the same. In the submarine warfare, for example, the "U-boat" crews had no alternative but to destroy merchant ships when so ordered, but whether they were acting under specific instructions in pursuing their victims in open boats, and adding to the perils of the occasion in other ways, is a matter which the Allied Commission must determine. It might be a good plan, when the plea of "under orders" is put forward by the Germans, to make its acceptance conditional on the revelation of those orders, or the names of those responsible for issuing them. If the accused parties wish to shift the blame—and, as has been said, there were occasions when the men who executed outrages had no option in the matter—they ought at least to show on whom the onus should rest.—*The Army and Navy Gazette*, Jan. 24, 1920.

ITALY REDUCES NAVY STRENGTH.—Rear Admiral Secchi, Italian Minister of Marine, is reported in a dispatch from Rome to have informed a newspaper in that city that since the armistice Italy has sold 40 warships and expects to sell 93 more when mine-sweeping operations are completed. He is reported as having added that it has been decided to abandon construction of 4 battleships of the first class, planned before the war, for the reason that they are regarded as vulnerable to submarine attack.—*Army and Navy Journal*, Feb. 28, 1920.

WOULD HAVE MORE WEST POINTS.—"Since it is the duty of a country to be prepared the question is how it may be so prepared at the least possible cost," says the *New York Sun*. "Here is a suggestion not without merit, measured as business men would measure the problem confronting America in the matter of military protection and the maintenance of national dignity. It is this: Let the government straightaway establish eight or ten more West Points for the training of officers and establish two or three more naval schools like Annapolis. Without an enormous increase in naval craft we could not use to advantage the same number of naval officers as we can use of military officers. It is clear to us in this juncture of domestic and foreign affairs that we must either have a large standing army or a large number of trained officers, as they are trained at West Point, who can take our militia organizations and our raw man-power and on short notice organize them into efficient fighting forces. An investment in eight or ten more West Points would be eminently wise, eminently practical. But suppose we have no wars,

no troubles at home, would the money expended on these additional institutions of learning and military training be lost? Certainly it would not be lost. In a perfectly practical sense it would be well worth the expenditure in the development of so large a number of trained engineers, trained workers, trained organizers as these institutions would turn out annually. In peace times they would prove a tremendous asset to the country and in times of war, their value would be beyond the computation of any living man."—*Army and Navy Journal*, Feb. 21, 1920.

CRUISER STERNS.—The cruiser stern was first introduced in naval vessels. It was recognized that length of water-line was favorable to speed, and consequently the under-water body was extended as far as possible aft of the stern-post, forming an immersed counter or cruiser stern.

The first large liners to have the cruiser stern were the *Empress of Russia* and the *Empress of Asia*, built in 1913. Among coasting vessels the introduction had taken place in the *Prince Rupert* and *Prince George*, built in 1910, and now Lloyds Register contained the names of over 150 cruiser-sterned vessels.

To illustrate the advantages of the cruiser stern, the case is considered of a twin-screw passenger and cargo vessel, 550 feet in length, in which it is desired to carry 2800 tons of cargo in addition to passengers, stores, and water, and fuel for a voyage of 3000 miles at a mean speed of 18 knots. Particulars of such a vessel are given: (a) As constructed with ordinary overhung counter; (b) with cruiser stern in place of overhung counter. It is shown that the adoption of the latter results in a saving of nearly 2000 horse-power, and of 220 tons of fuel—or about 11 per cent for the particular trip.

The characteristics of the mercantile cruiser stern are considered, it being pointed out that this is very dissimilar in appearance to the naval cruiser stern—the two having but one common factor, the immersion of the counter. Difficulties experienced in the housing of propellers in cruiser-sterned vessels—in particular, the large propellers of geared-turbine installations—are dealt with and solutions suggested. The paper concludes with the statement that, "as regards cost, strength, stability, seaworthiness, and absence of vibration, the new form (of stern) is at least as good as its predecessor."—*The Technical Review*, Feb. 3, 1920.

SWITZERLAND'S OUTLET TO THE SEA.—Swiss engineers fear that the provision of the peace treaty which gives France the sole right to take water from the Rhine for navigation or irrigation purposes, or for power, may mean the end of Switzerland's aspiration for an all-water route to the sea. German success in opening the Rhine for navigation as far as Strassburg had led the Swiss to hope that Basle would some day succeed Strassburg as the head of Rhine river traffic. They now fear that French occupation of Alsace will only increase the opposition of Strassburg interests to a project which has been a Swiss dream for decades, and which would give Europe's oldest republic a direct access to the sea.—*The Nautical Gazette*, Feb. 7, 1920.

A MILITARY POLICY FOR THE UNITED STATES.—The following is an extract from the report of the Chief of Staff for 1919 regarding the adoption of a military policy by the United States:

"For the first time in its history this country is now, as the result of the war, in a position to formulate a definite military policy. All studies which have been made in this connection prior to the war have, necessarily, been academic. There has existed no supply of trained officers or men or of equipment and stores commensurate with the requirements of such a policy. No definite or adequate policy could be formulated which did not contemplate universal military service in time of war as the source of a national army; no precedents existed which warranted the assumption that such a

system would be accepted by the country. Any war plans that might be prepared could only provide, on paper, for the disposition to be made of armies and supplies that did not exist, which could not be made available in case of an emergency and which could only be created by slow and evolutionary processes the nature of which could not be foreseen. Such plans were necessarily academic. To-day the entire situation is changed. The country has universally accepted and demanded, as the only rational and equitable solution of the problem, that the great army required for our participation in this war be raised by the draft, and the nation-wide support of the draft act and the general satisfaction with its operation and its results can leave no doubt but that it may be accepted as the future policy of the country in time of war.

"There are to-day in the country nearly 4,000,000 men and 200,000 officers physically and mentally fit and trained for war. No such reserve exists in any other country. It may be relied upon to meet the requirements of any possible contingency that may arise within the next five years. There is also a reserve of artillery, ammunition, motor transport, machine guns, rifles, and other military essentials that will amply provide for any possible requirement in the near future."—*Infantry Journal*, February, 1920.

LOGISTICS.—Logistics is a subject with which the average officer gives himself little concern. Practically, he takes the attitude of a man in a hotel dining-room. He orders what he needs and wants, gets it and goes away profoundly ignorant of what has taken place behind the swinging door through which the waiter disappeared.

We know that there are certain services charged with responsibility for supplying us with the food, clothing, equipment, money, quarters and transportation we need for carrying on the military business. How they manage to do all this is more or less a mystery to most of us. We content ourselves with going to the local supply officer, finance officer, and transportation officer for what we need, knowing only in a general way that back of each of these officers is some sort of an organization that keeps the wheels going around.

There is a certain amount of reason why this should be so. In the first place, each of us finds enough in our daily work to occupy our time and thought. Another and more pertinent reason is that our supply system in the past has not been one readily understandable. Study of it forces us to the conclusion that the subject of military supply has not been given the thought it demands. We have been satisfied to leave such arrangements to those concerned in its actual operation, accepting what comes to us in the nature of manna.

Typical of this attitude has been our tactical instruction. In none of our work, theoretical or practical, have we ever given more than passing thought to the intricate and important system of supply upon which the success of military operations must depend. Figuratively, we have limited ourselves to paragraphs 1, 2, 3, and 5 of the Field Order, leaving paragraph 4 to look out for itself. The fallacy of such a course has been demonstrated conclusively in every important military operation we have undertaken. Briefly, in each our supply service has invariably failed either wholly or in part, and we have been confronted with the task of remodelling it and bolstering it up while operating under war pressure.

When we realize the part logistics must play in our military projects, the folly of haphazard arrangement for supply and its associated activities is obvious. Success in war depends primarily on logistics. No matter how well we may be prepared in other ways, unless our plans are based on sound logistical organization, confusion and inefficiency are bound to obtain and operations will suffer accordingly.

One obstacle we have encountered in the past has been the element of personal equation in legislation affecting supply organization. The personal equation is an important consideration in all organization, and sound

organization should provide for the exercise of initiative on the part of the individuals composing it. To blanket ambition means to stifle initiative. But ambition must always be subordinate to sound principles and to the demands of proper organization.

The present Congress, the Senate in particular, is giving more than usual attention to the subject of supply organization. In their consideration of the subject, they are making use of their experience in the late war. In general, they are inclining to a service of supply based on the sound principles of consolidation in all common activities—consolidated purchase, storage and issue of supplies; consolidated construction, transportation, and finance.

The proposed legislation is a long step in advance from the haphazard and piecemeal policy that has characterized treatment of supply organization in the past. In it appears a determination to benefit from the lessons of the late war. While it is true that our part in that war was not of sufficient duration to admit of complete practical development in our supply policy, nevertheless it was enough to point us in the right direction. The advantages of consolidation in matters of transportation, finance, construction and supply, with proper coördination of all on the part of the General Staff, are too obvious for argument. Briefly, these steps spell business-like organization, and they will be the forerunners of business-like methods in this most important phase in the conduct of war.

The proposed arrangement will involve a re-distribution of many activities exercised before the war by the various services and a consequent curtailing of some of these fields. Needless to say, the proposal will not meet with unqualified approval. However, unpartisan analysis based on our recent experience must bring all concerned to a realization of its soundness.

Fortunately Congress has read these lessons aright. It is interpreting them with excellent judgment and wisdom. Any who may be tempted to oppose objection to the proposed measure will do well to weigh the consequences to our military future.—*Infantry Journal*, February, 1920.

CURRENT NAVAL AND PROFESSIONAL PAPERS

The Causes of the Disintegration of Water Tube Boilers and How They May Be Avoided. *Schiffbau*, August 27, 1919.

Observations and Recommendations in Regard to Improvement of Ports. *Monthly Bulletin of the American Association of Port Authorities.* February 1, 1920.

Serbia To-day and To-morrow. By Anthony D. Well. *The Nineteenth Century and After*, December, 1919.

The New Theory of Gravity. By Sir Oliver Lodge, F. R. S. *The Nineteenth Century and After*, December, 1919.

Mr. Wilson and the Treaty. By Sydney Brooks. *The Nineteenth Century and After*, December, 1919.

The War Cloud in the East. By Fabricus. *The Fortnightly Review*, November, 1919.

NOTES ON INTERNATIONAL AFFAIRS

FROM FEBRUARY 15 TO MARCH 15

PREPARED BY

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ADRIATIC QUESTION STILL UNSETTLED

PRESIDENT WILSON AGAINST PLAN OF JAN. 14.—In a vigorous note to France and Great Britain President Wilson on Feb. 10 stated his opposition to the revised Adriatic proposals as presented to Jugo-Slavia, declaring them a serious departure to the advantage of Italy from the French-British-American proposals of Dec. 9. Taken in sequence, the correspondence and proposals regarding the Adriatic situation may be summarized as follows:

I. *Joint British-French-American Memorandum of Dec. 9*, which established an independent Albania under Italian protection, a fairly large "buffer" state of Fiume and surrounding territory, and a boundary scheme as indicated in the accompanying map. This Italy refused to accept.

II. *British-French Revised Proposals of Jan. 14.*—The chief differences between this plan and that of Dec. 9 were: (1) That it reduced Albania and gave sections of it to Jugo-Slavia, Greece, and Italy; (2) it did away with the buffer state of Fiume, giving Jugo-Slavia inland territory with a population of 150,000 Slavs, but giving Italy a strip of territory along the coast containing 50,000 Slavs and extending her territory to the city of Fiume. The latter was to become a free city, under League of Nations control, with its own choice of diplomatic representation. These terms were handed to Jugo-Slavia with the statement that if they were not accepted, the Treaty of London would be carried out.

III. *President Wilson's Protest of Feb. 10.*—Following an inquiry regarding the Adriatic negotiations, President Wilson on Feb. 10 framed a note stating his objections to the terms of Jan. 14 on the grounds: (1) That the cession to Italy of a strip of sea-coast connecting it with Fiume was in violation of accepted principles of the peace settlement; (2) that the creation of Fiume as a small free city under League control paved the way for Italian annexation; (3) that the strip dominated the railway leading north from Fiume; (4) that the new proposals called for the partition of Albania. The note in closing raised the possibility of American withdrawal from the European settlement:

"The President desires to say that if it does not appear feasible to secure acceptance of the just and generous concessions offered by the British, French and American Governments to Italy in the joint memorandum of those powers of Dec. 9, 1919, which the President has already

clearly stated to be the maximum concession that the Government of the United States can offer, the President desires to say that he must take under serious consideration the withdrawal of the treaty with Germany and the agreement between the United States and France of June 28, 1919, which are now before the Senate and permitting the terms of the European settlement to be independently established and enforced by the associated governments.

"LANSING."

IV. *Premiers' Reply of Feb. 17.*—In a joint note of Feb. 17 the British and French Premiers replied in conciliatory terms to the American remonstrance, and answered at length the objections raised. The note declared that both Jugo-Slavs and Italians were averse to the buffer state of Fiume originally proposed, and that the revised proposals aimed to please Jugo-Slavia as well as Italy, giving to Jugo-Slavia a useful slice of Albania. The note concluded with expressions of surprise and regret at the American threat of withdrawal.

V. *The President's Rejoinder of Feb. 24.*—This note defended the President's earlier position, argued that the consent of Jugo-Slavia as well as Italy should have been sought before altering the terms of Dec. 9, and suggested direct negotiations between the two states primarily concerned.

VI. *The Franco-British reply of Feb. 26* agreed to direct negotiations, with renewed discussion by the major powers in the event of failure.

VII. *The President's Note of March 4* dwelt chiefly on the general principles involved in the question. It insisted that no joint agreement between Jugo-Slavia and Italy should disregard the rights of Albania, reiterated the President's stand for the terms of Dec. 9, and restated the objections to the Treaty of London.

Jugo-Slavia Proposes Modifications.—Having in her first communications raised objections to the proposed Adriatic settlement, Jugo-Slavia on Jan. 22 signified acceptance on the following conditions: (1) The plan for a buffer state of Fiume would be accepted if there were no departure from the "Wilson" boundary; (2) the internationalization of Zara was accepted, on condition that the city should not have choice of diplomatic representatives, which would be "disguised annexation" by Italy; (3) partition of Albania was accepted, though it was considered better that Albania should have independent sovereignty over all her territory; (4) cession of islands to Italy was granted, with the exception of Lissa.

SENATE STILL DEBATES PEACE TREATY

PRESIDENT OPPOSED TO "MILD NULLIFICATION."—Senate discussion of the peace treaty was renewed in February and March, and the treaty was finally defeated on March 19.

In an extended letter to Senator Hitchcock, dated March 8, the President expressed willingness to accept purely explanatory reservations, but declared again that any reservation that weakened Art. X "cut at the very heart and life of the covenant itself" and made it "hardly more than a futile scrap of paper." The acceptance of Art. X, according to the Presi-

—*N. Y. Times*, Feb. 27.

dent, "constituted a renunciation of all ambition on the part of the powerful nations with whom we were associated in the war . . . . Throughout the sessions of the conference in Paris it was evident that a militaristic party, under the most influential leadership, was seeking to gain ascendency in the counsels of France. They were defeated then, but they are in control now." [This statement was later the subject of diplomatic inquiries on the part of the French Ambassador in Washington.] The letter was throughout an appeal for unqualified ratification as essential to the establishment of better international relations. The letter closed thus:

"I need not say, Senator, that I have given a great deal of thought to the whole matter of reservations proposed in connection with the ratification of the treaty and particularly that portion of the treaty which contains the covenant of the League of Nations, and I have been struck by the fact that practically every so-called reservation was in effect a rather sweeping nullification of the terms of the treaty itself.

"I hear of reservationists and mild-reservationists, but I cannot understand the difference between a nullifier and a mild nullifier. Our responsibility as a nation in this turning point of history is an overwhelming one, and, if I had the opportunity, I would beg every one concerned to consider the matter in the light of what it is possible to accomplish for humanity, rather than in the light of special national interests.

"WOODROW WILSON."

"HON. GILBERT M. HITCHCOCK,
"United States Senate."

RESERVATIONS ADOPTED.—In the course of Senate debate, reservations similar to those proposed at the time when the treaty was first before the chamber were again one by one approved by majority votes, including the reservation against votes for British commonwealths within the empire. Regarding this reservation, Mr. N. W. Rowell, President of the Canadian Privy Council, made the following statement on March 11:

"If the American Senate should continue and adopt the reservations now before the Senate and the President should approve them, a situation would arise where the question of the United States coming in or not might depend upon the action of Canada.

"It is a grave responsibility for us to say that under those serious conditions, recognizing what the situation is in Europe and elsewhere, we would not give the necessary consent in order to permit them to come in. But because we believe that it goes to the very basis of Canada's whole national future, that her future depends upon it, we could not possibly give consent, because on the one hand we are neither prepared to cut the tie that binds us to the mother country nor are we prepared on the other hand to go back to the old colonial relation. That is the alternative we have to face."

Views expressed by both sides in Parliament sustained the Government's stand.

On March 13 Senator Lodge proposed a slightly revised reservation on Art. X, somewhat milder in language than the one which he had previously insisted upon.

MINOR POWERS JOIN LEAGUE OF NATIONS.—On March 10 it was announced that Switzerland, Denmark, Sweden, Norway, and Holland, or all but two of the thirteen neutrals invited to join the League of Nations, had definitely accepted. In reply to an inquiry from Norway, Lord Cecil, British

representative of the League, expressed the opinion that membership of the League implied no duty to keep up military forces.

Of the remaining neutrals, Salvador and Venezuela, Salvador addressed a preliminary note to the United States for further definition of the Monroe Doctrine. The reply being acceptable, Salvador on March 12 joined the League of Nations. Venezuela also became a member.

DEFINITION OF THE MONROE DOCTRINE.—Washington, March 1.—A reply has been made by the United States Government to the recent request of Salvador for an interpretation of the Monroe Doctrine.

The reply refers to what President Wilson said on that subject in an address he delivered in Washington on January 6, 1916, before the Pan American Scientific Congress.

In the speech referred to President Wilson declared that "the Monroe Doctrine was proclaimed by the United States on her own authority"; that "it has always been maintained, and always will be maintained, on her own responsibility," and went on to say that the doctrine "demanded merely that European governments should not attempt to extend their political systems to this side of the Atlantic," adding, however, that "it did not disclose the use which the United States intended to make of her power on this side of the Atlantic."

Doubts and suspicions that had arisen on this point must be removed, President Wilson declared, asserting that America "must establish the foundations of amity so that no one will hereafter doubt them."

He hoped this could be achieved, and suggested the following means by which this might be accomplished:

"It will be accomplished, in the first place, by the states of America uniting in guaranteeing to each other absolute political independence and territorial integrity," he said. "In the second place, and as a necessary corollary to that, guaranteeing the agreement to settle all pending boundary disputes as soon as possible and by amicable process; by agreeing that all disputes among themselves, should they unhappily arise, will be handled by patient, impartial investigation and settled by arbitration; and the agreement, necessary to the peace of America, that no state of either continent will permit revolutionary expeditions against another state to be fitted out on its territory, and that they will prohibit the exportation of munitions of war for the purpose of supplying revolutionists against neighboring governments."—*N. Y. Times*, March 2.

HUNGARY

EASIER TREATY TERMS.—London, March 12.—A new Hungarian Peace Treaty has been definitely agreed upon by the Peace Conference and placed in the hands of a Drafting Committee, which has gone to Paris. It is expected that the treaty will be completed within a week.

The territorial terms against which Hungary protested so vigorously remain unchanged, but various economic concessions have been granted.

It is stated that in re-framing the economic clauses, particularly regarding the reparations to be demanded, the Conference took a much more lenient attitude than prevailed in Paris.—*N. Y. Times*, March 13.

GERMANY

PROPOSED ECONOMIC CONCESSIONS.—Paris, March 5.—France has neither signed nor approved the declaration regarding the economic situation of Europe which the Allied Supreme Council has proposed to make, according to statements made here to-day.

The original text of the Allied declaration, it is stated, begins by setting forth that the small nations bordering on Russia must be obliged to make peace with the Russian Soviet Government in order that the economic revival may begin.

It follows with the statement that Germany must be provided with the means of resuming industrial activity, and that, since the prosperity of Europe depends upon the prosperity of all countries, it is proposed that a loan be made to Germany guaranteed by German assets in priority to reparation payments, the loan payments to be controlled by neutral commission.

It is stated that instructions are being sent to Ambassador Cambon in London that he sign the declaration with the following reservations:

First—France will not join in any pressure upon the small countries along the Russian border to oblige them to make peace with the Soviet.

Second—France will not consent to giving any priority over reparations on any assets of Germany pledged for that purpose.

Third—France will not consent to the control of German payments on any loan Germany may make by any other organization than the Reparations Commission.—*N. Y. Times*, March 6.

HOLLAND AGAIN REFUSES SURRENDER OF EX-KAISER.—In a note of March 5 Holland again declined to turn the former German Emperor over to the Allied powers, declaring that she had taken, and would continue to take, measures requisite to subject the freedom of the former Emperor to necessary limitations.

REACTIONARY COUP A FAILURE.—On March 13 the Ebert Government was overthrown in Berlin and a reactionary government was set up. The new Ministry as announced included Dr. Kapp, chancellor, and Major General Baron von Luettwitz, Minister of Defense.

The military coup was executed without blood shed, control of troops being secured by their fear of disbandment under the Socialist régime. The new government gave protection to foreigners and gave its promise to fulfil honorably the Treaty of Versailles. Before he withdrew President Ebert called on the workingmen of Germany for a general strike as the only way of defeating the new government. This threat led quickly to the restoration of Ebert's control.

RUSSIA

SOVIET PEACE PROPOSALS.—Renewed peace proposals to the United States and other powers were made by the Soviet Government of Russia on Feb. 24. According to press reports the proposals gave assurances of democratic government, payment of 60 per cent of Russia's foreign debt with arrears of interest, and guarantees in the form of economic and mining concessions, on condition that other countries would abandon intervention in Russian affairs. The letter to the U. S. State Department appeared in the press from foreign sources, but was not given out in Washington. It contained no specific terms.

ALLIES WILL ENCOURAGE TRADE.—On Feb. 24 the Council of Allied Premiers issued a statement of Russian policy embodying the following points.

1. The Allied governments "cannot accept the responsibility of advising border states to continue war with Russia, but will help them defend their legitimate frontiers if attacked."

2. "The Allies cannot enter into diplomatic relations with the Soviet Government, until they have arrived at the conviction that the Bolshevist horrors have come to an end."

3. "Commerce . . . . will be encouraged to the utmost degree possible without relaxation of the attitude described above."

4. The Allies suggest that the Council of the League of Nations send a commission to Russia.

POLISH NEGOTIATIONS BROKEN OFF.—In February Poland framed terms on which she would make peace with Russia, and submitted these terms for the approval of the Allies. They included demands for indemnity, recognition of the independence of the Baltic states, guarantees against propaganda, and self-determination for all territory west of the old Polish frontier of 1772. The Poles, however, refused a preliminary armistice before negotiations, and afterward defeated an offensive undertaken by Soviet forces.

In March an agreement was concluded with the U. S. Shipping Board and Liquidation Commission by which Poland secured a large quantity of military equipment, rolling stock, and food stuffs.

LEAGUE COUNCIL TO SEND COMMISSION TO RUSSIA.—At the third meeting of the League of Nations Council, held in Paris on March 13, the question was taken up of sending a commission of inquiry to Russia, as suggested by the Supreme Council.

TURKEY

SULTAN TO STAY IN CONSTANTINOPLE.—During February discussion of Turkish treaty terms progressed to the point where it was decided that the Sultan should retain his court in Constantinople, but that the Straits should be placed under international control. Turkish retention of Constantinople was favored by France and accepted by Great Britain in deference to the sentiments of the Mohammedan population under British rule. It was decided on March 2 that Turkey should be entirely deprived of a navy. Her former population of 30 million will be reduced to 6 million by the treaty terms. The preliminary draft of the Turkish treaty was completed on March 11, and a copy sent to President Wilson for his consideration.

In Parliament, on Feb. 26, Premier Lloyd George defended the Turkish settlement as follows:

> The influence which had decided the Peace Conference to retain the Turks in Constantinople, the Premier continued, had come from India. The two peace delegates of India in Paris, neither of whom was a Mohammedan, had declared that unless the Allies retained the Turks in Constantinople their action would be regarded as a gross breach of faith on the part of the British Empire.

Without the aid of India, Mr. Lloyd George pointed out, Turkey could not have been conquered, and nothing could be more damaging to British prestige in Asia than the feeling that Great Britain did not keep her word. He promised, however, that when the peace terms were disclosed they would be found drastic enough to satisfy Turkey's bitterest foe.

"Let us examine our legitimate and main peace aims in Turkey," the Premier went on. "The first is the freedom of the Straits. The second is the freeing of all non-Turkish communities from the Ottoman army. The third is the preservation for the Turks of self-government in communities which are mainly Turkish, subject to two most important reservations."

Mr. Lloyd George explained that the freedom of the Straits would be assured because all of Turkey's forts would be dismantled, she would have no troops within reach and would not be permitted to have a navy, while the Allies would garrison the Straits. The only alternative, he said, was an international military government of Constantinople and all the surrounding territory, which would be very unsatisfactory and costly to the Allies.

MASSACRES IN ASIA MINOR.—According to a French official report, 5000 Armenians were massacred in the Marash region of central Asia Minor during February. The French garrison of occupation in the city of Marash was besieged by Turkish forces for a month, and was forced to evacuate on February 11. Massacres in Cilicia continued throughout the month.

Pressure on Constantinople had little effect, since all Asia Minor is controlled by the Nationalist party under Mustapha Kemal, with headquarters at Angora. On March 10, the new Turkish Grand Vizier, Sali Pasha, announced a cabinet of a stronger Nationalist tendency than that which resigned on March 7.

PUNITIVE MEASURES ADOPTED.—On March 8 it was stated that there were 16,000 French troops in Constantinople and that England would send 34,000 more. A strong Allied naval force occupied the Dardanelles. In the official communique of the council meeting in London on March 10 it was stated that "If the remnant of the Armenians should suffer further, some responsibility must fall also on the nation which, associated with this problem by very fine traditions, is for such a purpose (protection) strongest and freest of all."

London, Thursday, March 11.—The disciplinary occupation of Constantinople, as it may be called to distinguish it from the ordinary occupation which followed the conclusion of the armistice, has been definitely ordered by the Allied Powers and will be carried out at once. For the present it will consist in posting Allied contingents at strategic points of the city on both sides of the Golden Horn. For this purpose there are troops enough on the spot, and more can be brought up in a few days.

Any question of further measures will be answered according as this unsensational demonstration is or is not effective in bringing home to the Turkish Government and the people the determination of the Allies that provincial disorders shall cease and the terms of the Peace Treaty be executed scrupulously.—*N. Y. Times*, March 13.

NO AMERICAN OBJECTION TO COERCION OF TURKS.—It is understood that the measures decided upon by the Supreme Council in dealing with Turkey are purely coercive, and, as the American attitude heretofore has

persistently been one of benevolent interest in the fate of the Armenian and other peoples oppressed by the Turks, it is scarcely expected that any opposition will be offered by the State Department to the execution of the Council's program.

According to information received here, the representations to be made to the American Government by the Entente include recommendations that American naval strength in the Turkish waters be largely augmented.

Military forces now in Turkey, according to official intelligence, include 33,000 British, 18,000 French, 16,000 Italian and 100,000 Greeks. The Turkish Regular Army of 43,000 men is disposed with 9000 men in Europe and 34,000 in Asia. About 60 per cent of the Asiatic forces are said to be pro-Nationalist.

FAR EAST

CHINA DIVIDED ON NEGOTIATION WITH JAPAN.—Washington, Feb. 19.—The resignation simultaneously of Lou Tesng-Tsiang, the Chinese Minister of Foreign Affairs, and also of Chen-Lu, the Chinese Vice Foreign Minister, is attributed to pressure exerted by the Anfu party in Peking, the conservative party now in control of the Central Government, as a result of the Foreign Minister's opposition to direct negotiations by China with Japan over the Shantung question.

The resignation of these two officials under existing circumstances is expected to cause a strong reaction throughout China by reason of the strong popular feeling in all parts of the country against the Anfu policy of submitting the Shantung settlement to direct negotiation with Japan. The present situation will add to the already bitter anti-Japanese feeling which is being demonstrated by the boycott in China against Japanese products.—*N. Y. Times,* Feb. 20.

JAPANESE TRADE MONOPOLY IN PACIFIC ISLANDS.—It is reported that, in the South Pacific Islands under Japanese mandatory, the Japanese have not only taken over former German trade but have almost completely superseded the British, whose business there formerly amounted to over £400,000.

REVIEW OF BOOKS

ON

SUBJECTS OF PROFESSIONAL INTEREST

"Electric Oscillations and Waves." By George W. Pierce, Ph.D., Professor of Physics in Harvard University. 486 pages, with appendix and tables of Relations of Capacity-Inductance Product to Undamped Wave Length and Frequency of a Circuit, Together with Squares of Wave Lengths. (Published by McGraw-Hill, New York.)

A mathematical treatment of some of the fundamentals of the theory of electric oscillations and electric waves with application to radio telegraphy, telephony and optics. It is considerably beyond the comprehension of the average student of radio telegraphy, which combined with the omission of such important subjects as spark gaps, arcs, vacuum tubes, direction finders, electric wave propagation, etc., unfits it for use as a text-book except for advanced radio engineers. It is of value as a reference work and supplements the author's earlier work "The Principles of Wireless Telegraphy."

Book I deals with electric oscillations: Chapter I, Fundamental Laws and Equations, Kirchhoff's Law Applied to Oscillating Circuits.—II, The Flow of Electricity in a Circuit Containing Resistance, Self Inductance and Capacity. Discharge, Charge and Current Interruptions.—III, Energy Transformations During Charge or Discharge of a Condenser.—IV, Geometry of Complex Quantities.—V, Circuit Containing Resistance, Self Inductance Capacity, and a Sinusoidal Impressed E. M. F.—VI. Electrical Resonance in Simple Circuit.—VII, The Free Oscillations of Two Coupled Resistanceless Circuits. Periods and Wave Lengths.—VIII, The Free Oscillations of Two Coupled Resistanceless Circuits. Amplitudes.—IX, The Free Oscillation of Two Inductively Coupled Circuits. Periods and Decrements.—X, Amplitude and Mean Square Current in the Inductively Coupled System of Two Circuits.—XI, Theory of Two Coupled Circuits Under the Action of an Impressed Sinusoidal E. M. F.—XII, Resonance Relations in Radio Receiving Stations Under the Action of Persistent Incident Waves.—XIII, A General Reciprocity Theorem in Steady State A. C. Theory with Application to the Determination of Resonance Relations.—XIV, Resonance Relations in a Chain of Three Circuits with Constant Pure Mutual Impedances.—XV, Resonance Relations in a Radio Receiving Station Having a Coupled System of Circuits with Detector in Shunt, to be a Secondary Condenser.—XVI, Electrical Systems of Recurrent Similar Sections. Artificial lines. Electrical Filters.—XVII, Electric Waves on Wires in Steady State.

Book II: Chapter I, Electrostatics and Magnetostatics.—II, Maxwell's Equations.—III, Energy of the Electromagnetic Field Poynting's Vector.—IV, Wave Equations. Plane Wave Solution.—V, Reflection of a Plane Wave from a Perfect Conductor.—VI, Vitreous Reflection and Refraction.—VII, Electric Waves in an Imperfectly Conductive Medium.—VIII, Electric Waves Due to an Oscillating Doublet.—IX, Theoretical Investigation of the Radiation Characteristics of an Antenna.

H. A.